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ABSTRACT

This report describes a three-year project aimed at improving mathematics education in grades 6-9 in Birmingham, Alabama. The purpose of the project was to enhance mathematical knowledge and improve the instructional skills of middle school mathematics teachers (n=58) through an innovative teacher enhancement program. Since the middle school years are considered crucial in the development of a student's view of mathematics, the study is aimed at developing well-trained mathematics teachers. The goals of the project were to focus on teaching behavior, knowledge, and attitudes of middle school mathematics teachers in order to enhance the quality of mathematics instruction, promote positive student attitudes toward mathematics, improve students' mathematics achievement, and increase the talent pool of underrepresented groups. Teachers believed the project was successful, stating that it helped them most in providing additional ways of making mathematics more meaningful to students. The teachers also believed the new skills revitalized them in their profession. Appendices contain the evaluation plan, the survey instruments, and the National Science Foundation Participation Project Information Sheet. (AIM)

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ED 401 129

Improving Mathematics Education in Grades 6-9 Through the Integration of Content, Technology, and Manipulatives

A Teacher Enhancement Project Sponsored by the National Science Foundation and the University of Alabama at Birmingham

Formal Cumulative Evaluation Report

May, 1996

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I. Introduction: Purpose and Objectives

This project entitled "Improving Mathematics Education in Grades 6-9 Through the Integration of Content, Technology, and Manipulatives" was awarded to the University of Alabama at Birmingham School of Education by the National Science Foundation's Teacher Enhancement Division for the project period of 1992-1995. The purpose of this project was to enhance mathematical knowledge and improve instructional skills of middle school (grades 6-9) mathematics teachers through an innovative teacher enhancement program. Since the middle school years are the crucial developmental bridge between a child's optimistic view of personal competency and one's adolescent debilitating belief that he/she cannot learn mathematics (Johnson, 1990), it is important to have well-trained mathematics teachers who can correctly guide students in gaining mathematics prowess. The proposed goals of this project were to focus on the teaching behavior, knowledge, and attitudes of middle grades (6-9) mathematics teachers in order to: (1) enhance the quality of mathematics instruction, (2) promote positive student attitudes toward mathematics, (3) improve students' mathematics achievement, and (4) increase the talent pool of underrepresented groups.

Examining both improvement in content knowledge and pedagogical skills, together with technological skills, was a major focus of this project. As such, it was necessary to find answers to these questions, each of which directly relates to objectives of the evaluation plan.

Specifically, **how effective has this project been at:**

1) increasing teacher knowledge of appropriate mathematical concepts?

2) increasing teacher proficiency and comfort level in the use of selected mathematical tools and technology?

3) increasing teacher instructional skills at applying technology in middle school mathematics classrooms?

4) increasing teacher capacity to developed instructional units incorporating appropriate mathematical concepts, tools, technology, and instructional strategies?

5) increasing teacher knowledge of strategies designed to enhance positive student attitudes toward mathematics?

6) increasing teacher ability to implement strategies and instructional materials gained through this project?

7) developing a viable "Teachers Helping Teachers Network" that is meaningful to both mentor and mentee?

8) and, increasing teacher sensitivity toward students' diverse learning styles, particularly minority and underrepresented groups?

Each of these above questions encompass part of the overall project evaluation, and as such, each question will be discussed separately throughout this report.

The following sections of this report describe in detail the important aspects of this overall project as well as overall outcomes of this project; II provides a description of the evaluation plan together with instruments used, while III gives quantitative and qualitative results of this project. Last, IV provides a discussion of the findings and conclusions based on results of the cumulative data.

II. Evaluation Plan:

The design for the evaluation of this Teacher Enhancement Program combined both quantitative and qualitative components to examine objectives stated above. An outline of the evaluation plan can be found in Appendix A of this report.

Sample: Sixty (60) middle school teachers from the Birmingham/Jefferson County general area were initially chosen to participate in this project. However, two participants -- one in the second year and one in the third year -- left the project before completion; therefore, this cumulative overall evaluation report is based on data obtained from fifty-eight (58) participants. Specifics on these participants can be found in the Cumulative Demographic Report which is provided as a separate document.

Instruments:

Instruments for this project, as noted, were both quantitative and qualitative. The following is a list, together with pertinent information, regarding instruments used. All are found in Appendix B.

A) Quantitative Assessment: The following quantitative instruments were used:

1) Pre/Posttests Measures and Grades Assigned: Algebra/Probability and Statistics and Geometry pre/posttests were used by project instructors, as well as grades to measure content gain;

2) Technology/Manipulatives Quantitative Measures: Throughout this project, three different scales, one with two subscales, were used to measure not only self-reported proficiencies of teachers as they related to technology and manipulatives, but also to measure attitudes of computer use in the classroom, be they teacher competencies or student competencies. As such, these scales were collapsed into one overall Technology Scale with the following four areas:

a) Participant Evaluations of Project Effectiveness Relative to Technology and Manipulatives - Evaluator-developed questions designed to assess the degree to which participants felt the project had been effective in facilitating their acquisition of technology and manipulatives skills for classroom integration were used. Specifically, under "A: Computer Usage" questions #1 - 5 were evaluator-developed questions used for participants to self report their ***Computer Proficiency***. Using a Likert Scale from 1 = Strongly Disagree to 5 = Strongly Agree, scores could range from a low of 5 to a high of 25. Further, on the second page, under "Manipulatives," questions #1 - 4 were used for participants to self-report their ***Manipulatives Proficiency***, again using a Likert Scale as mentioned above, with scores ranging from a low of 4 to a high of 20, again with 5 = Strongly Agree to 1 = Strongly Disagree.

b) Microcomputer Utilization in Teaching Efficacy Beliefs Instruments (MUTEBI) - This instrument, developed by Enochs, Riggs and Ellis (Enochs, Riggs & Ellis, 1993)

was used in this project to assess participant outcome expectancy and personal efficacy as they relate to computer use. As noted by the authors, this instrument can be used to "investigate teachers' microcomputer self-efficacy beliefs in regard to any subject area by simply instructing teachers as to the specific subject area prior to administration of the instrument." That was, in fact, the way this instrument was used in this project. According to the authors, "personal efficacy" items are used to assess "teachers beliefs" in their own ability to utilize the microcomputer for effective instruction, while "outcome expectancy" items are used to evaluate "teachers beliefs" with regard to teacher responsibility for students' ability or inability to utilize the microcomputer in the classrooms. In other words, do "teachers believe that students' competence in microcomputer usage is more likely given an effective teacher" (P.258). Again, using a Likert Scale as noted above, scores ranged from a low of 1 = Strongly Disagree to a High of 5 = Strongly Agree. Because this scale was divided into two subscales -- Outcome Expectancy and Personal Efficacy-- minimum and maximum scores differed according to the subscale. On Outcome Expectancy, the scores ranged from a low of 6 to a high of 30, since it was comprised of six items. On the Personal Efficacy subscale, scores ranged from a low of 9 to a high of 45. Six of the nine items on the Personal Efficacy subscale were reversed scored; in other words, 1 = strongly agree and 5 = strongly disagree. Those items are italicized on all tables where these subscales are discussed.

According to (Enochs et al., 1993), the MUTEBI is a valid and reliable instrument for use in investigations of microcomputer inservice training. They reported confirmatory factor analyses of Bandura's two constructs of outcome expectancy and personal efficacy. Reliability coefficients for outcome expectancy was .78 (Cronbach's alpha) and .91 for Personal Efficacy (Cronbach's alpha).

c) Barriers to Using Manipulatives Scale - This scale, the author unknown, was used to measure the degree to which participants felt, after having gone through this project, that certain barriers continued to be impediments to their use of these instructional tools in the class. Scores ranged from a high of Strongly Agree = 5 to Strongly Disagree = 1.

3) Implementation Matrix of NCTM Standards - This scale, designed to assess the quality of individually-developed participant projects during this workshop, was comprised of eleven categories by which each participant project was independently rated by a qualified professional mathematician. Scores ranged from a low of 1 = Poor to 5 = Excellent in each of the eleven categories.

4) Fennema-Sherman Mathematics Attitudes Scales - Four of the nine scales of the Fennema-Sherman Mathematics Attitude Scale (Fennema & Sherman, 1976) were used in this project to measure student attitudes toward mathematics. The four subscales of the Fennema-Sherman Mathematics Attitude Scale which were used are described as follows, and each description is taken verbatim from the technical manual which accompanies the scales:

a) Teacher Scale - This scale was "designed to measure students' perceptions of their teachers' attitudes toward them as learners of mathematics. It includes the teachers' interests, encouragement, and confidence in the student's ability."

b) Confidence in Learning Mathematics Scale - This scale was "designed to measure confidence in one's ability to learn and to perform well on mathematical tasks. The dimension ranges from distinct lack of confidence to definite confidence. The scale is not intended to measure anxiety and/or mental confusion, interest, enjoyment, or zest in problem solving."

c) Attitudes Toward Success in Mathematics Scale - This scale was "designed to measure the degree to which students anticipate positive or negative consequences as a result of success in mathematics. They evidence this fear by anticipating negative consequences of success as well as by lack of acceptance or responsibility for the success, e.g., "It was just luck.'"

d) Mathematics Usefulness Scale - This scale was "designed to measure students' beliefs about the usefulness of mathematics currently and in relationship to their future education, vocation, or other activities."

On the Fennema-Sherman Scale, each of the subscales consist of six positively stated and six negatively stated items using a five-point Likert Scale. Although in the individuual yearly reports, scoring has taken place where 1 = Strongly Agree to 5 = Strongly Disagree, which was in contrast to other likert scales used in this evaluation, except the Evaluator-Developed Scale mentioned below, on this final cumulative report, scoring was changed so that 5=Strongly Agree to 1=Strongly Disagree. The original procedure of 5=Strongly Disagree to 1=Strongly Agree was initially used because of the type of National Computer Systems optical scan form which was used. Response blanks began moving from left to right, with the form

already predetermined with "1" in the far left response blank. And, because students generally think of "agree" as being presented before "disagree," the scale numerical values range from 1 = Strongly Agree to 5 = Strongly Disagree. This scale plus that mentioned directly below in #5 were the only scales of all used that possessed this type scoring in the individual yearly reports. However, on this final cumulative report, scoring was reversed to correspond more closely with other scales in the overall evaluation; or 1=Strongly Disagree to 5=Strongly Agree.

Several criteria (in order of importance), according to the authors of these instruments, were used in selecting items included in the final versions of the Fennema-Sherman scales: (1) items which correlated highest with the total score for each sex; (2) items with higher standard deviations for each sex; (3) items which yielded results consistent with theoretical constructs of a scale; and (d) items which differentiated mathematics from non-mathematics students. Split-half reliabilities were computed and are as follows for each of the four scales used in this project: Teacher Scale = .88; Confidence in Learning Mathematics = .93; Usefulness of Mathematics = .88; and Attitude Toward Success in Mathematics = .87. A principal component factor analysis was conducted yielding items included in the factors which provides evidence of construct validity of the scales. Therefore, estimates of validity and reliability were considered to be within acceptable limits for use in this evaluation project.

5) Evaluator-Developed Student Assessment of Teachers Scale- At the beginning of Fennema-Sherman Mathematics Attitude Scale, seven evaluator-developed items were used to assess student attitudes about project participants' teaching ability. Again, a Likert Scale was used with 1=Strongly Agree to 5=Strongly Disagree because it was part of the overall National Computer Systems form. The reliability coefficient for this scale was .82, as seen in Table 41.

6) Dunn Teaching Styles Inventory (Dunn & Dunn, 1977) - According to Dunn and Frazier 1990), teaching style is defined in terms of eight major classifications: (a) instructional planning; (b) teaching methods; (c) teaching environment which is comprised of three subcategories: (i) student groupings; (ii) room design; (iii) teaching environment; (d) evaluation

techniques; (e) instructional characteristics, and (f) educational philosophy. Each are described below:

a) Instructional Planning - Instructional Planning "includes the elements of diagnosis and prescription for each student or group of students. Diagnosis is concerned with each student's ability, developmental characteristics, learning history, interests, and learning style. Prescription includes student advisement, goal setting, instructional objectives, and placement" (Dunn & Dunn, 1977).

b) Teaching Methods - "Teaching Methods and techniques generally describe the instructor's behavior in the classroom--the way he/she utilizes various resources, interacts with students, and employs basic approaches to teaching and learning" (Dunn & Frazier, 1990).

c) Teaching Environment - The Teaching Environment Scale is comprised of three subscales discussed below. In the most general sense, according to Dunn and Dunn (1977), it involves instructional stations and centers, furniture arrangement, and provisions for mobility and nutrition.

i) Student Groupings - Student Grouping refer to the types of groupings teachers use to teach, whether they be small groups, pairs, large groups, flexible groupings, individually, and one-to-one tutoring.

ii) Room Design - This characterizes the way in "which a teacher divides, decorates, and designs learning areas and how these arrangements modify the instructional environment."

iii) Teaching Environment - This subscale includes "time schedules, learning activities and resources, and provisions for student mobility and intake."

d) Evaluation Techniques - This scale describes types of evaluation techniques teachers choose to use.

e) Instructional Characteristics - Teaching characteristics "are defined as the values and standards a teacher holds and the operational approach he/she uses to transmit them. The degree of flexibility, the elements of learning stressed, and the amount of direction

given to students are teaching characteristics that result in different classroom management approaches" (Dunn & Frazier, 1990).

f) Educational Philosophy - According to Zahorik (1986), educational philosophy "is included as a factor of teaching style on the assumption that all teachers hold certain values and beliefs regarding education that serve as a basis for their teaching approach."

Although no specific validity coefficients are available for this measure, according to Rita Dunn (personal communication, 1993; March, 1996), this scale has been used by many school districts in teacher inservice activities for years. Further, she stated acceptable reliability coefficients have been established through dissertations; however, they were also calculated for this group of participants and are presented later in the report.

7) Mentee Evaluations - A quantitative (and qualitative to be discussed later) measure of how mentees rated their involvement in this NSF project was performed by having them complete a questionnaire of 12 pertinent items taken from the National Council of Teachers of Mathematics *Standards* (National Council of Teachers of Mathematics, 1989). An evaluator-developed questionnaire, this Likert Scale asked mentees to evaluate their participation in this program on these items from strongly agreeing (5) to strongly disagreeing (1).

8) Exit Interviews - Similarly, an exit evaluation (both quantitative and qualitative in nature) was completed by participants in order to measure how they rated their involvement in this program relative to pertinent NCTM *Standards*. Again, this evaluator-developed questionnaire used a 5-point Likert Scale with answers possibly ranging from Strongly Agree (5) to Strongly Disagree (l).

9) Myers-Briggs Type Indicator - This personality type indicator consists of slightly over 100 items which report "preferences" for behaving. It consists of four polarities: Introversion-Extraversion, Sensing-Intuition, Thinking-Feeling, and Judgment-Perception. "Extraverts" orient themselves to the world around them and tend to adapt easily and are generally friendly and open. Introverts, on the other hand, are less consumed by the world

around them, while they seem to be drawn to focus mainly on their internal states, thoughts, and ideas. "Sensors" rely on objective data that can be directly observed. They are influenced most by concrete facts and figures and other types of exact information. "Intuitives," on the other hand, depend on "hunches" to solve problems. They are spontaneous, original, and are able to deal with abstractions. "Thinkers" view the world in accordance with specific laws and logical, orderly systems. "Feelers" by contrast, base their judgments on emotion in order for their conclusions to be consonant with their value systems which already exists (Jung, 1923). "Judging" types of individuals control life by dismissing perceptions or focusing attention away from perceptions. Judging utilizes decision-making processes that, once sufficiently utilized in making a decision, are not exercised individually when new information is presented (Myers, 1962). "Perceptive" individuals attempt to gain an understanding of situations in life and modify themselves or adapt to their environment. Further, they make use of all information in their decision-making processes to gain or gather additional information.

Scoring of this instrument consists of assessing each person's number of items answered from each of the eight scales which yields raw scores. For example, each person receives a raw score on each of the eight polarities. On each polarity, difference scores are obtained between the ends of a particular polarity (I-E, for example) which are assigned according to a predetermined scale. Each person's final "preference" is indicated as one end of each of the four polarities -- for example, "ISTJ." Validity and reliability statistics for this instrument are reported extensively in the norms technical manual, the Myers-Briggs Type Indicator, (Myers, 1962) with both being credible for a self-report instrument of this sort.

B) Qualitative Instruments - The following evaluator-developed qualitative instruments were administered to project participants in order gain more in-depth information regarding their perceptions of this project. The instruments given were as follows:

1) Mentor Evaluations - Qualitative assessments were administered to each participant in order to assess their feelings about their mentees, how effective they believed this aspect of the project was, as well as other important information regarding this relationship.

2) Mentee Evaluations - Similarly, mentees too were asked what they liked about this aspect of the project, what they gained from their relationship, what changes they would make, and how they think being involved in this program helped them professionally.

3) Teacher Perceptions of Student Achievement - Qualitative data regarding teacher impressions of their students' achievement were collected in an attempt to assess whether participants felt their skill and knowledge gained from this project actually translated into achievement gains in their students. Various questions relative to this issue were collected from project participants.

4) NSF Participant-Developed Project Data Forms - In order to more accurately assess how participant-developed projects were used when participants returned to their respective schools, information in a qualitative form was collected from teachers regarding their project, when they used it, if it was modified, other units participants implemented which were acquired from the project, as well as communication with others in their schools about their projects.

5) Exit Interview - Qualitative information at the end of the project was obtained from participants relative to what skills they learned which aided them in increasing positive student attitudes about math and being more sensitive to cultural differences. Further, they were asked, as a result of this project, if they had become more actively involved in professional associations, and if so what professional activities they had engaged in as a result of this project. Finally, project professionals were interested in gaining information on how participants believe this project has helped them to become better teachers, and as such, they were specifically asked.

6) Classroom Observation Schedule - Participants for all years were each observed by two independent raters (evaluators) in order to assess their teaching effectiveness. Observations were performed mid-year after their participation in the workshop, but prior to the conclusion of all follow-up sessions. An evaluator-developed instrument was used to assess eleven different aspects of teaching behavior which are as follows: (a) Classroom Climate; (b)

Classroom Management; (c) Teacher Communication, both Verbal and Nonverbal; (d) Competency/Preparation; (e) Instructional Style; (f) Materials/Equipment; (g) Physical Arrangement of Classroom; (h) Student/Teacher Interaction; (i) Technology Integration; (j) Time Management Skills; and (k) Cultural Sensitivity. Although some of these scales went beyond the scope of this project, results for all are reported later.

7) Focus Groups - Focus groups were held with participants for each of the three years to collect follow-up data in order to more effectively evaluate the degree to which individuals were successful in implementing strategies, techniques, etc. acquired through this project. Information regarding results of the focus groups is contained in this final Cumulative Report.

III. Results and Analyses:

QUESTION #1:

How effective was the project at increasing teacher knowledge of appropriate mathematical concepts? (Objective #1)

Measurement of this first objective was assessed through quantitative and qualitative data. Results of t-tests run on the cumulative pre/posttest data measuring content knowledge reveal a significant difference in scores of participants in both Algebra/Probability and Statistics and Geometry, as can be seen by viewing Tables 1 and 2 below.

Table 1.
t-Test: Paired Two Sample for Algebra Means

Statistics	Pre-Test	Post-Test
Mean	0.70	0.79
Variance	0.03	0.02
Observations	58	58
Pearson Correlation	0.75	
Hypothesized Mean Difference	0	
df	57	
t Stat	-6.26	sig. ∂≤ .05
P(T<=t) one-tail	0.00	
t Critical one-tail	1.67	
P(T<=t) two-tail	0.00	
t Critical two-tail	2.00	
Pre- Post-Test Change——	————>	0.09
Standard Deviation	0.17	0.14

Table 2.
t-Test: Paired Two Sample for Geometry Means

Statistics	Pre-Test	Post-Test
Mean	0.71	0.84
Variance	0.06	0.04
Observations	58	58
Pearson Correlation	0.83	
Hypothesized Mean Difference	0	
df	57	
t Stat	-7.28	sig. ∂≤ .05
P(T<=t) one-tail	0.00	
t Critical one-tail	1.67	
P(T<=t) two-tail	0.00	
t Critical two-tail	2.00	
Pre- Post-Test Change——	——————>	.13
Standard Deviation	.24	.2

In comparing the three years individually relative to Algebra, Years #1 and #2 participants showed significant differences between pre/posttesting in Algebra and Probability/Statistics, but there was not a significant difference found for Year #3 in Algebra and Probability/Statistics. In Geometry, participants in all three years showed significant differences between pre/posttesting, all of which were disclosed through t-testing. For specifics, please refer to individual yearly reports.

Because the instructor for Algebra and Probability/Statistics modified the pretest after the first year which changed the total point value of the scale in Year #1 from 110 points to a total point value in Years #2 and #3 of 100 points, only percentages are used for calculations.

Table 3 shows Algebra and Probability/Statistics pre/posttest change score ranges by years. In comparing the years, a Year #1 participant received the lowest pretest Algebra percentage score (19%) with a Year #3 participant receiving the highest pretest percentage score (100%). When viewing posttesting, a Year #1 participant again disclosed the lowest posttest score (14%) with a Year #3 participant obtaining the highest posttest score (100%). The lowest change score was obtained by a Year #3 participant (-15%), with the highest change score being obtained by a Year #2 participant (46%).

Table 3.
Algebra and Probability/Statistics Ranges of Scoring by Years

Algebra	Year 1		Year 2		Year 3		All	
in %	Low	High	Low	High	Low	High	Low	High
Pre-test	19	95	35	95	48	100	19	100
Post-test	14	98	50	97	52	100	14	100
Change	-5	28	-10	46	-15	26	-15	46

Table 4 shows shows the same range information in Geometry. And, because reporting for Algebra was performed in percentages, so has the reporting of Geometry been performed in percentages. In comparing the years, a Year #1 participant received the lowest pretest Geometry percentage score (15%) with Year #1 and #3 participants receiving the highest pretest percentage score (100%). When viewing posttesting, Year #1 again disclosed the lowest posttesting score (12%) with participants from all three years obtaining equally highest posttest score (100%). The lowest change score was obtained by a participant in Year #2 (-5) , with the highest change score being obtained in Year #1 (67%).

Table 4.
Geometry Ranges of Scoring by Years

Geometry	Year 1		Year 2		Year 3		All	
in %	Low	High	Low	High	Low	High	Low	High
Pre-test	15	100	26	97	45	100	15	100
Post-test	12	100	21	100	58	100	12	100
Change	-3	67	-5	29	-3	24	-5	67

Table 5 shows pre/posttesting by grade for the entire project in Algebra and Probability/Statistics. As can be seen from this table, the average pretest score was 70%, the average posttest score was 79%, with the average change score being 9%. The highest pretest mean was gained by eighth grade teachers, the highest average posttest score was obtained by eighth graders, but the highest change score obtained was by sixth grade teachers.

Table 5.
Pre/Posttest Averages by Grade Taught for Algebra and Probability/Statistics

Grade Taught	PreTest Mean%	SD%	PostTest Mean%	SD%	Change Score Mean%	SD%	# Cases
All	70	17	79	15	09	11	58
Grade 9	72	16	79	10	07	11	21
Grade 8	76	15	85	13	09	08	18
Grade 7	74	13	84	12	10	12	9
Grade 6	52	16	67	22	15	15	10

From Table 6, analysis of variance disclosed a significant difference between pretest scores from grade to grade. Through a subsequent Duncan's Multiple Range Test, it was disclosed that the 6th grade average Algebra pretest scores were significantly lower than the average pretest Algebra scores of the other three grades.

Table 6.
ANOVA of Algebra Pretest Scores by Grade

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	3	1.15	0.38	12.51	0.00
Within Groups	53	1.63	0.03		
TOTAL	56	2.78			sig ∂≤ .05*

From Table 7, analysis of variance again disclosed a signficant difference between posttest scores on Algebra. And, again, through subsequent Duncan's Multiple Range Testing, it was disclosed that the 6th grade average Algebra posttest scores were significantly lower than the average posttest Algebra scores of the other three grades.

Table 7.
ANOVA of Algebra Posttest Scores by Grade

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	3	0.66	0.22	8.22	0.00
Within Groups	53	1.41	0.03		
TOTAL	56	2.07			sig ∂≤ .05*

However, as can be seen from Table 8, analysis of variance of pre/posttest Algebra change scores did not disclose a significant difference. In other words, from grade to grade, no particular group appeared to show change scores which were significantly better than other grades.

Table 8.
ANOVA of Algebra Change Scores by Grade

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	3	0.07	0.02	1.69	0.18
Within Groups	53	0.74	0.01		
TOTAL	57	0.81			n.s

As can be seen from Table 9, the average pretest score for Geometry was 72%, the average posttest score was 84%, with the average change score being 12%. The highest pretest mean was gained by eighth grade teachers, the average posttest means were equally high among ninth, eighth, and seventh grade graders. Again, as was the case with Algebra and Probability/Statistics, the highest change score obtained was by sixth grade teachers.

Table 9.
Pre/Posttest Averages by Grade Taught for Geometry

Grade Taught	PreTest Mean%	SD%	PostTest Mean%	SD%	Change Score Mean%	SD%	# Cases
All	72	22	84	19	12	14	57
Grade 9	78	17	89	11	11	08	20
Grade 8	80	19	89	18	09	08	18
Grade 7	78	16	89	09	12	11	9
Grade 6	41	17	61	26	20	21	10

From Table 10, analysis of variance disclosed a significant difference between grades relative to pretest scores obtained. Through Duncan's Multiple Range Testing, it was disclosed that the 6th grade average Geometry pretest scores were significantly lower than the average Geometry pretest scores of the other three grades.

Table 10.
ANOVA of Geometry Pretest Scores by Grade

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	3	1.09	0.36	8.89	0.00
Within Groups	54	2.21	0.04		
TOTAL	57	3.29			sig $\partial \leq .05^*$

From Table 11, analysis of variance disclosed a significant difference between posttest scores obtained from grade to grade. Subsequent Duncan's Multiple Range Testing disclosed that 6th grade average posttest score obtained was significantly lower than the average posttest scores of the other three grades.

Table 11.
ANOVA of Geometry Posttest Scores by Grade

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	3	0.64	0.21	7.71	0.00
Within Groups	54	1.49	0.03		
TOTAL	57	2.12			sign. $\partial \leq .05^*$

However, as can be seen from Table 12, analysis of variance of pre/posttest Geometry change scores did not disclose a significant difference. In other words, from grade to grade, no particular group appeared to show change scores which were significantly better than other grades.

Table 12.
ANOVA of Geometry Change Scores by Grade

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	3	0.07	0.02	1.27	0.29
Within Groups	54	0.97	0.02		
TOTAL	57	1.04			n.s

On qualitative workshop evaluations, when participants were asked if this institute helped them to increase their mathematical knowledge and/or confidence in their ability to deal with mathematical questions put to them by students, across the three years, participants overwhelmingly answered in the affirmative. Further, participants who responded noted that this workshop assisted them in gaining new content knowledge as well as skill at using manipulatives and computers so that teaching with this new knowledge made them more effective and stimulating to their students.

QUESTION #2:

How effective has this project been at increasing teacher proficiency in the use of selected mathematical tools and technology?

(Objective #2)

According to incoming evaluation data obtained from participants across the three years, some 62% of them did not use computers as an instructional aid in their classrooms, while the remaining 38% said they did use them to some degree.

In order to assess the impact this project had on acquiring better computer and manipulatives skills, an (a) evaluator-developed instrument, (b) the Technology Scale which is composed of two subscales –Outcome Expectancy and Personal Efficacy– and (c) end of term grades were used to assess proficiency at technology. Although the MUTEBI instrument is shown in its entirety in Table 13 and was administered to participants in that fashion, various sections of it measure different elements of the project. Specifically, looking at the entire technology instrument given, under "A: Computer Usage" questions #1 - 5 were evaluator-developed/modified questions used for participants to self report their ***computer proficiency***.

Table 13.
Selected Item Statistics for Technologies
n=58

Note: Items shown in italics were reversed scored. Strongly Agree=1.....Strongly Disagree=5.	SA=5	A=4	U=3	D=2	SD=1	Mean	St. Dev.
A. Computer Usage:							
1. As a result of having participated in this NSF project, I have learned additional uses of the computer for my class.	55	43	2	0	0	4.53	0.54
2. I am more proficient at using the computer as an instructional resource as a result of having participated in this NSF project.	33	59	7	2	0	4.22	0.65
3. I am more confident in using computers in my classroom as a result of having participated in this NSF workshop.	41	47	12	0	0	4.29	0.68
4. After having participated in this NSF project, I understand computer capabilities well enough to be effective in using them in my classroom.	36	53	7	3	0	4.22	0.73
5. As a result of participating in this project, I now use computers in my class more frequently than before attending this project.	26	48	10	16	0	3.84	0.99
6. When a student shows improvement in using the computer, it is often because I exerted a little extra effort.	12	35	43	10	0	3.48	0.84
7. When my students' attitudes toward using computers improve, it is often due to my having used the classroom computer(s) in more effective ways.	26	36	26	12	0	3.76	0.98
8. The teacher is generally responsible for students' competence in computer usage.	17	43	28	12	0	3.66	0.91
9. My students' computer ability is directly related to my effectiveness in classroom computer use.	10	29	38	22	0	3.28	0.93
10. My students' computer ability is directly related to my effectiveness in classroom computer use.	5	33	40	22	0	3.21	0.85
11. If parents comment that their child is showing more interest in computers, it is probably due to my performance.	2	22	57	19	0	3.07	0.70
12. Even when I try very hard, I do not use the computer as well as I do other instructional resources.	5	31	16	43	5	3.12	1.08
13. I am not very effective in monitoring students' computer use in my class.	3	12	24	53	7	3.48	0.92
14. I don't find it as difficult to explain to students how to use the computer, since participating in this workshop.	10	64	22	2	2	3.79	0.72
15. I am typically able to answer students' questions which relate to the computer.	17	67	10	5	0	3.97	0.70
16. Given a choice, I would not invite the principal to evaluate my computer-based instruction.	7	10	17	50	16	3.57	1.09
17. When students have difficulty with the computer, I am usually at a loss as to how to help them.	0	5	22	48	24	3.91	0.82
18. When using the computer, I usually welcome student questions.	22	66	9	3	0	4.07	0.67
19. I do not know what to do to turn students on to computers.	0	2	10	64	24	4.10	0.64
20. Whenever I can, I avoid using computers in the classroom.	0	2	7	57	35	4.24	0.66

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(Technology Scale Continued)

B. Manipulatives:	SA=5	A=4	U=3	D=2	SD=1	Mean	Std Dev
1. As a result of participating in this NSF project, I use manipulatives in my class when they fit the lesson I am teaching.	50	43	7	0	0	4.43	0.62
2. As a result of participating in this project, I use manipulatives more effectively in my math class.	47	48	5	0	0	4.41	0.59
3. I feel comfortable using manipulatives in my math teaching as a result of having participated in this NSF project.	40	53	3	2	2	4.28	0.77
4. I have gained necessary teaching skills to use manipulatives in my class through participating in this NSF project.	40	53	5	2	0	4.29	0.73
5. Which of the following are possible barriers to your greater use of manipulatives in your classroom:							
a. they cost too much money.	2	26	12	47	14	3.48	1.22
b. they take too much time.	0	26	16	40	19	2.55	1.08
c. the students will be too noisy.	2	12	9	50	28	2.48	1.08
d. they take up too much space.	3	12	5	52	28	2.10	1.00
e. I don't have any.	0	3	14	45	38	2.12	1.06
f. my principal doesn't like them.	3	24	2	45	26	1.83	0.80
g. I have to cover the book.	2	17	9	53	19	2.34	1.21
h. clean-up takes too long.	0	0	2	52	47	2.29	1.03
i. the kids don't learn anything with them.	0	0	14	53	33	1.84	2.22
j. parents don't like them.	2	29	10	35	24	1.81	0.66
k. they will get lost, broken, or stolen.	0	24	16	38	22	2.50	1.20
l. the kids are hyper when I have tried to use them in the past.	0	24	16	38	22	2.41	1.09
m. I don't know how to use them.	0	5	2	57	36	1.76	0.73
n. they are not geared to a particular grade level.	2	14	5	48	31	2.07	1.04
o. children only play with them.	0	9	10	55	26	2.02	0.85
p. organizing them is a hassle.	0	22	9	50	19	2.34	1.04
q. storing them is a hassle.	3	21	7	48	21	2.38	1.14
r. children have to learn to use paper and pencil.	2	16	16	48	19	2.33	1.02
s. it takes too much planning time.	3	16	12	50	19	2.34	1.07
t. I like the way I teach, and I don't want to change.	2	5	10	62	21	2.05	0.83

Under "Manipulatives," questions #1 - 4 were used for participants to self-report their ***manipulatives proficiency***. Questions #6 - 20 on the preceding page came from the "Microcomputer Utilization in Teaching Efficacy Beliefs Instrument (MUTEBI), by Enochs, Riggs, and Ellis (1993). On Page 2 of this instrument, questions 5a-u came from an instrument entitled "Attitudes Toward Manipulatives in Mathematics Teaching." Although this instrument is shown in its entirety here as it was administered, only computer proficiency and manipulatives proficiency will be discussed under Objective #2. The other two scales which measure teacher beliefs about using the computer and barriers to using the computer will be discussed more fully under Objective #3 in this report.

From Table 14, the mean of the items which comprise the *computer proficiency* subscale was 4.22, which indicates participants had a favorable attitude toward the concepts reflected

by these items. Cronbach's alpha coefficient was .83. Further, the mean of the items which comprise the *manipulatives proficiency* subscale was 4.35, which also indicates participants favorable attitude toward the concepts reflected by these items. Cronbach's alpha for this subscale was .90.

In Table 15, range scores for computer and manipulatives proficiency by years are shown. Specifically, participants ranged from a low of 15 to a high of 25, out of a possible 25 points on *computer proficiency*. Participants obtained perfect scores on computer proficiency in each year. The range of obtained scores for *manipulatives proficiency* was from a low of 10 to a high of 20 out of 20 points. All three years had individuals obtaining perfect manipulatives proficiency scores also.

Table 14.
Selected Statistics on Computer and Manipulatives Subscale

Subscale	Item Mean	Variance	Alpha Reliability	# of Cases
Computer Proficiency	4.22	.06	.83	58
Manipulatives Proficiency	4.35	.01	.90	58

Table 15.
Score Ranges of Computer and Manipulatives Proficiency By Year

Efficacy of	Year 1		Year 2		Year 3		All	
Technology	Low	High	Low	High	Low	High	Low	High
Subscales								
Computer Profficiency	16	25	15	25	16	25	15	25
Manipulative Profficiency	16	20	11	20	10	20	10	20

From participants own assessments of their proficiency of selected technologies from this project, it appears that, as a group, they felt that professionals of this project did a good job in facilitating their acquisition of computer and manipulatives skills (mean of 21.12 out of 25 for computers; mean of 17.41 out of a possible 20 for manipulatives), both of which will be shown in tabular form later in this report.

A. Computer Proficiency: Relative to participant evaluations of computer instruction seen in Table 16, some 98% of participants agreed or strongly agreed they have learned additional uses of the computer for their classes from this workshop (Question #1). Some 92% report being more proficient at using the computer as an instructional resource as a result of participating in this workshop (Question #2). Eighty-nine percent (89%) reported that they understand computer capabilities well enough to be effective in their class as a result of this workshop (Question #4). Some 88% agreed or strongly agreed that they are more confident in using computers in the classroom as a result of participating in this project (Question #3). Finally, 74% agreed or strongly agreed that, as a result of this program, they now use computers in their classes more frequently than before attending this workshop (Question #5). Specifically relating to Question #5, in Year #3, 79% agreed or strongly agreed, in Year #1, 85% agreed or strongly agreed, and in Year #2, 58% agreed or strongly agreed that they use computers in their classes more frequently now than before attending this workshop.

As noted earlier, scores for "Computer Proficiency" could range from a low of 5 to a high of 25. On *computer proficiency*, the mean score for Year #3 participants was higher than that for Year #2 participants, but lower than Year #1 participants' mean score, as can be noted by referring back to individual yearly reports.

One can see the average proficiency scores by grades for computers in Tables 17 below. From this table, it can be seen that average computer proficiency scores ranged from a low of 20.78 for seventh grade teachers to a high of 21.40 obtained by sixth grade teachers. The mean obtained through self-report measures of how much participants felt they learned relative to using the computer was 21.12, with a standard deviation of 2.82. However, as can be seen in Table 18, the difference in means between the various grades was not significant. It appears, therefore, that participants in all four grades across all three years feel as though they profited reasonably equally from computer instruction.

Table 16.
Participant Evaluations of Computer Instruction
n=58

Computer Proficiency Items	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Mean	Std Dev
1. As a result of having participated in this NSF project, I have learned additional uses of the computer for my class.	55	43	2	0	0	4.53	0.54
2. I am more proficient at using the computer as an instructional resource as a result of having participated in this NSF project.	33	59	7	2	0	4.22	0.65
3. I am more confident in using computers in my classroom as a result of having participating in this NSF workshop.	41	47	12	0	0	4.29	0.68
4. After having participated in this NSF project, I understand computer capabilities well enough to be effective in using them in my classroom.	36	53	7	3	0	4.22	0.73
5. As a result of participating in this project, I now use computers in my class more frequently than before attending this project.	26	48	10	16	0	3.84	0.99
Overall Average---------->	38.2	50.0	7.6	4.2	0	4.22	0.72

Table 17.
Average Computer Proficiency Scores by Grade

Grade Level	Mean	Std Dev	Cases
All Participants	21.12	2.82	58
Grade 9	21.00	3.16	21
Grade 8	21.28	2.63	18
Grade 7	20.78	3.03	9
Grade 6	21.40	2.59	10

Table 18.
ANOVA of Computer Proficiency by Grade

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	3	2.59	0.86	0.10	0.96
Within Groups	54	451.57	8.36		
TOTAL	57	454.16			n.s.

B. Manipulatives Proficiency: According to Table 19, some 95% agreed to strongly agreed that they now use manipulatives more effectively as a result of participating in this project (Question #2). Ninety-three percent (93%) agreed or strongly agreed on each of the following points as a result of participation in this workshop: (a) they use manipulatives in their class when they fit the lesson; (b) they are comfortable using manipulatives in their math teaching; and (c) they have gained necessary teaching skills to use manipulatives in their classes. The

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mean of 4.35 gained on participants' manipulatives evaluation reveals they felt positively about what they had learned relative to this teaching tool during this workshop.

On *manipulatives proficiency*, Year #3 participants overall mean rating was lower than for any of the two previous years, all of which can be noted by referring back to individual yearly reports.

Table 19.
Participant Evaluations of Manipulatives Instruction
n=58

Manipulatives Items:	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Mean	Std Dev
1. As a result of participating in this NSF project, I use manipulatives in my class when they fit the lesson I am teaching.	50	43	7	0	0	4.43	0.62
2. As a result of participating in this project, I use manipulatives more effectively in my math class.	47	48	5	0	0	4.41	0.59
3. I feel comfortable using manipulatives in my math teaching as a result of having participated in this NSF project.	40	53	3	2	2	4.28	0.77
4. I have gained necessary teaching skills to use manipulatives in my class through participating in this NSF project.	40	53	5	2	0	4.29	0.73
Overall Average——————————>	44.3	49.3	5.0	1.0	0.5	4.35	0.68

As noted earlier, scores for "Manipulatives Proficiency" could range from a low of 4 to a high of 20. As can be seen from Table 20, the mean obtained through self-report measure of how much participants felt they learned relative to the use of manipulatives was 17.41, with a standard deviation of 2.40. Further, one can see the average proficiency scores by grades for manipulatives in Table 20. From this table, it can be seen that average manipulatives proficiency scores ranged from a low of 16.76 gained by ninth grade teachers to a high of 17.89 obtained by seventh grade teachers. However, as can be seen in Table 21, again, there was no significant difference between means of participants at any particular grade level relative to manipulatives proficiency, as noted by the non-significant *F*. Therefore, it appears that participants in all of the four grades across all three years represented (6 - 9) in this project profited fairly equally from their manipulatives instruction.

Table 20.
Average Manipulatives Proficiency Scores by Grade

Grade Level	Mean	Std Dev	Cases
All Participants	17.41	2.40	58
Grade 9	16.76	2.39	21
Grade 8	17.83	1.86	18
Grade 7	17.89	2.76	9
Grade 6	17.60	2.99	10

Table 21.
ANOVA of Manipulatives Proficiency by Grade

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	3	14.47	4.82	0.83	0.48
Within Groups	54	313.60	5.81		
TOTAL	57	328.07			n.s.

Finally, as was noted in earlier reports, homework assignments, tests, and lab assignments figured in to the final grade(s) which each participant earned from this project and was found in the last two yearly reports under Appendix C. Each participant's capacity to utilize the computer and manipulatives in instruction was evaluated via these measures by project instructors. Therefore, as noted through the discussion of Objective #2, various methods of assessing participants' ability to use technology were utilized, and it appears that they profited from this instruction.

QUESTION #3:

How effective has this project been at increasing teacher knowledge of instructional skills at applying technology appropriate to middle school students? (Objective #3)

As can be noted from qualitative post-workshop evaluations of participants of all three years, they rated instruction on the use of computers and manipulatives as one of the high points of this project. Most, if not all, noted gaining more skill at using either the computer, specific software packages, and/or manipulatives with which they were previously unfamiliar. Apparently, from the above statistical information found in the previous objectives

covered, as a group, participants feel as though this project equipped them with not only the knowledge, but also the instructional skill, to be more effective in their classrooms.

Further, from narrative evaluation comments found in Appendix C of the Year #1 report and Appendix D of the last two yearly reports, it appears that participants from all three years found instructors as well as the skills gained, very valuable in their professional development relative to specific technologies in teaching mathematics to middle school students.

As was noted under Objective #2 above, the MUTEBI was used in this project evaluation to assess teacher efficacy of the computer, but was to be covered more completely under this objective. Recall, however, that this instrument was imbedded in an overall instrument given to participants that covered computers and manipulatives. This instrument was shown in its entirety under Objective #2.

According to Enochs, Riggs, and Ellis (Enochs et al., 1993), Bandura, in a 1977 article, hypothesized that "people high on both outcome expectancy and personal efficacy would act in an assured, decided manner. Low outcome expectancy paired with high personal efficacy might cause individuals to temporarily intensify their efforts but would eventually lead to frustration. Persons low on both variables would give up more readily if the desired outcomes were not reached immediately" (P.258). Therefore, relative to computer use, the authors noted that teachers who scored high on both variables would probably continue to utilize "their skill in computer-assisted instruction;" those high in personal efficacy but low in outcome expectancy might "avoid using computer-assisted instruction since low outcome expectancy indicates they see little possibility of positive outcome even given effective modeling." Finally, "those scoring low on both variables would also probably avoid computer-assisted instruction whenever possible because of their own perceived inadequacies." (P. 258).

As mentioned under Objective #2, Questions 6-20 of the Technology Instrument shown earlier were used to assess teacher self-efficacy. Specifically, Questions 6-11 assess *Outcome Expectancy*, while Questions 12-20 were used to assess *Personal Efficacy*. Scores on the Outcome

Expectancy section of this test could range from a low of 6 to a high of 30 (6 items x1-5 SD to SA scores). Similarly, scores on the Personal Efficacy section of this test can range from a low of 9 to a high of 45 (9 items x 1-5 SD to SA scores).

As can be seen from Table 22, scores on the Outcome Expectancy subscale ranged from a low of 13 to a high of 30 out of a possible 30 points. This highest score was gained in Year #2. On the Personal Efficacy subscale, scores ranged from a low to 22 to a high of 44, out of a possible 45 total points.

Table 22.
Score Ranges of Outcome Expectancy and Personal Efficacy Scales

Efficacy of	Year 1		Year 2		Year 3		All	
Technology	Low	High	Low	High	Low	High	Low	High
Subscales								
Outcome Expectancy	14	27	13	30	14	28	13	30
Personal Efficacy	24	44	22	41	24	43	22	44

As a group, the average Outcome Expectancy score was 20.45, with a standard deviation of 4.06. The average Personal Efficacy score was 34.26 with a standard deviation of 4.83, both of which will be noted later in tabular form.

Outcome Expectancy:

As can be seen from Table 23, the mean obtained through self-report measures of how much responsibility teachers believed they had relative to student's ability/inability to utilize the computer in class was 3.41, with a standard deviation of .87. Some 62% of participants agreed or strongly agreed that when students' attitudes toward computer use improves, it is often due to their having used the classroom computer in more effective ways (Question #7). Some 60% of teachers agreed or strongly agreed that the teacher is generally responsible for students' competence in computer usage (Question #8). Forty-seven percent (47%) agreed or strongly agreed that when a student shows improvement in using the computer, it is often because the teacher has exerted a little extra effort (Question #6). Thirty-nine percent (39%) agreed or strongly agreed that students' computer ability is directly related to their

effectiveness in classroom computer usage (Question #9). Finally, on Question #11, only 24% agreed or strongly agreed to "if parents comment that their child is showing more interest in computers, it is probably due to my performance." There was a relatively high level of uncertainty on this scale, as noted by the 38.7% undecided overall average. Year #2 participants showed the highest level of uncertainty with 46%; Year #3 participants gained the second highest level of uncertainty with 41%, while Year #1 participants revealed the lowest level of uncertainty on this scale with 29%, all of which is noted from earlier individual yearly reports.

Table 23.
Participant Evaluations of Outcome Expectancy

Outcome Expectanc y Items:	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Mean	Std Dev
6. When a student shows improvement in using the computer, it is often because I exerted a little extra effort.	12	35	43	10	0	3.48	0.84
7. When my students' attitudes toward using computers improve, it is often due to my having used the classroom computer(s) in more effective ways.	26	36	26	12	0	3.76	0.98
8. The teacher is generally responsible for students' competence in computer usage.	17	43	28	12	0	3.66	0.91
9. My students' computer ability is directly related to my effectiveness in classroom computer use.	10	29	38	22	0	3.28	0.93
10. My students' computer ability is directly related to my effectiveness in classroom computer use.	5	33	40	22	0	3.21	0.85
11. If parents comment that their child is showing more interest in computers, it is probably due to my performance.	2	22	57	19	0	3.07	0.70
Overall Average---------->	12.0	33.0	38.7	16.2	0	3.41	0.87

It appears, therefore, that teachers believe that they do have *some* impact on student *attitudes* relative to the computer. Year #3 participants appeared to believe they were more responsible for students' computer competence than the earlier two years, but perhaps they also believe that this too is a responsibility that should be shared with other teaching professionals, as apparently Years #1 and #2 participants probably also believed. This is noted because of the higher number of significant correlations between computer/manipulatives proficiency with efficacy beliefs found in Year #3.

One can see the overall average Outcome Expectancy scores by grades in Tables 24. From this table, it can be seen that average outcome expectancy scores ranged from a low of 19.78 gained by eighth grade teachers to a high of 22.50 gained by sixth grade teachers. The mean of all teachers was 20.45, with a standard deviation of 4.06. However, as can be seen in Table 25, there was no significant difference between means of participants at any particular grade level relative to outcome expectancy, as noted by the non-significant *F*.

Table 24.
Average Outcome Expectancy Scores by Grade

Grade Level	Mean	Std Dev	Cases
All Participants	20.45	4.06	58
Grade 9	20.24	4.27	21
Grade 8	19.78	4.19	18
Grade 7	20.00	4.39	9
Grade 6	22.50	2.80	10

Table 25.
ANOVA of Outcome Expectancy by Grade

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	3	52.92	17.64	1.07	0.37
Within Groups	54	887.42	16.43		
TOTAL	57	940.34			n.s.

It appears, therefore, that participants in all of the four grades across all three years represented (6 - 9) regard their responsibility for students' ability/inability to utilize the microcomputer in a similar fashion, with none at any grade level feeling more or less responsible.

Personal Efficacy:

As can be seen from Table 26, the overall item mean obtained through self-report measures of participants' own ability to utilize the computer for effective instruction was 3.81, with a standard deviation of .81. Some 92% of participants overall disagreed or strongly disagreed that they avoid using the computers in the classroom (Question #20). Eighty-eight (88%) disagreed or strongly disagreed with the statement that they would not know what to do to turn students on to the computer (Question #19). Further, 88% agreed or strongly agreed with

welcoming student questions regarding the computer (Question #18), while 84% agreed to strongly agreed regarding typically being able to answer students' questions which relate to the computer (Question #15). Some 74% of participants don't find it as difficult to explain to students how to use the computer now (Question #14); 72% disagreed or strongly disagreed that when students have difficulty with the computer, they are usually at a loss as to how to help them (Question #17); 66% disagreed or strongly disagreed that they would not invite their principal to evaluate their computer-based instruction (Question #16), and 60% disagreed or strongly disagreed with the idea that they are not very effective in monitoring students' computer use in the classroom (Question #13). Finally, on Question #12, "even when I try hard, I do not use the computer as well as I do other instructional resources," 48% disagreed or strongly disagreed.

Table 26.
Participant Evaluations of Personal Efficacy

Personal Efficacy Items **Note: Items shown in italics were reversed scored. Strongly Agree=1.....Strongly Disagree=5.**	% Selecting						
	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Mean	Std Dev
12. Even when I try very hard, I do not use the computer as well as I do other instructional resources.	5	31	16		5	3.12	1.08
13. I am not very effective in monitoring students' computer use in my class.	3	12	24	53	7	3.48	0.92
14. I don't find it as difficult to explain to students how to use the computer, since participating in this workshop.	10	64	22	2	2	3.79	0.72
15. I am typically able to answer students' questions which relate to the computer.	17	67	10	5	0	3.97	0.70
16. Given a choice, I would not invite the principal to evaluate my computer-based instruction.	7	10	17	50	16	3.57	1.09
17. When students have difficulty with the computer, I am usually at a loss as to how to help them.	0	5	22	48	24	3.91	0.82
18. When using the computer, I usually welcome student questions.	22	66	9	3	0	4.07	0.67
19. I do not know what to do to turn students on to computers.	0	2	10	64	24	4.10	0.64
20. Whenever I can, I avoid using computers in the classroom.	0	2	7	57	35	4.24	0.66
Overall Average------------->	7.1	28.8	15.2	15.2	12.6	3.81	0.81

When interpreting these means, please keep in mind the reverse scoring of the ***italicized*** items, since high mean values can be easily misinterpreted.

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Further, one can see the average Personal Efficacy scores by grades presented in Tables 27. From this table, it can be seen that average personal efficacy scores ranged from a low of 33.39 gained by eighth grade teachers to a high of 35.70 obtained by sixth grade teachers. However, as can be seen in Table 28, there was no significant difference between means of participants at any particular grade level relative to personal efficacy, as noted by the non-significant *F*.

Therefore, it appears that participants in all of the four grades across all three years represented (6 - 9) in this project similarly regard their ability to utilize the microcomputer for instruction. Specifically, they possess above average skills that are necessary to utilize the computer for effective classroom instruction.

Table 27.
Average Personal Efficacy Scores by Grade

Grade Level	Mean	Std Dev	Cases
All Participants	34.26	4.83	58
Grade 9	34.05	4.71	21
Grade 8	33.39	5.10	18
Grade 7	34.89	4.37	9
Grade 6	35.70	5.27	10

Table 28.
ANOVA of Personal Efficacy by Grade

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
Between Groups	3	38.90	12.97	0.54	0.65
Within Groups	54	1288.22	23.86		
TOTAL	57	1327.12			n.s.

Table 29 presents correlational data of selected technologies (computers and manipulatives) with efficacy beliefs (outcome expectancy and personal efficacy). As can be seen, there are five significant correlations, four at the .01 level and one at the .05 level of significance. Specifically, the .01 significant correlations are as follows: (a) computer proficiency and outcome expectancy, which means that the more proficient at using the computer participants rated themselves, the more responsibility they believed them had regarding their students' ability/inability to use the computer; (b) computer proficiency and

personal efficacy, which means that the more proficient at using the computer participants rated themselves, the more able they believed they were to use the computer for effective classroom instruction; (c) computer proficiency and manipulatives proficiency, which means the more proficient participants believe they are relative to using the computer, the higher they rated themselves regarding the ability to use manipulatives; and (d) outcome expectancy and personal efficacy, which means the more ability they believed they had to utilize the computer for effective classroom instruction, they more willing they were to take personal responsibility for their students' ability/inability to use the computer. Finally, there was one last significant correlation at the .05 level of confidence regarding outcome expectancy and manipulatives proficiency, which means the more proficient participants believed they were in using manipulatives, the more personal responsibility they were willing to take regarding their students' ability/inability to use computers. So, for this group of 58 teachers over the three year period of time, it appears that the skills they learned regarding computers and manipulatives had facilitated their own ability to utilize the computer for effective classroom instruction, as well as their willingness to take more personal responsibility for their students' computer literacy.

Table 29.
Correlations of Computer /Manipulatives Proficiency With Efficacy Beliefs

	Computer Proficiency	Outcome Expectancy	Personal Efficacy	Manipulative Proficiency
Computer Proficiency	1.00			
Outcome Expectancy	.48**	1.00		
Personal Efficacy	.54**	.42**	1.00	
Manipulative Proficiency	.39**	.29*	.22	1.00
	* Signif. LE .05		** Signif. LE .01	

In viewing the yearly participants as individual groups, results revealed that Year #3 participants showed the highest number of significant correlations regarding computer and manipulatives proficiency and personal efficacy beliefs, which can be seen by reviewing individual yearly reports.

Table 30 shows a varimax rotated factor matrix of technology scales. It is well known that the factor analysis of correlation matrices based on questionnaire items is hazardous. Nevertheless, at times such analyses can provide insight into the dimensions of an instrument that helps in the overall understanding of a project. A principal components analysis of the correlation matrix was computed. All factors with eigenvalues equal to or greater than 1.00 were retained and rotated to the varimax criterion. These standards disclosed six factors. Table 30 displays the rotated factor matrix and associated statistics. To aid in the interpretation of the analysis, only item/factor correlations equal to or greater than .20 (absolute value) were displayed. At the next stage, the focus was on the greatest correlation in each row. The result led to the interpretation that the first factor was indeed a Personal Efficacy factor, the second was a Manipulative Proficiency factor, the third was Outcome Expectancy and the fourth was Computer Proficiency. The remaining two factors remain unclear and are not named. It appears the four subscales are indeed separate dimensions and can be discussed independently.

Table 30.
Varimax Rotated Factor Matrix of Technology Scales

Item/Factor->	1	2	3	4	5	6	Communality
Com Prof1			0.20	0.75	0.33		0.76
Com Prof2	0.34	0.29		0.77			0.81
Com Prof3	0.20			0.84			0.80
Com Prof4	0.38			0.43	0.35	0.34	0.60
Com Prof5				0.45	0.72		0.75
Manip. Prof 1		0.80			0.25	-0.27	0.80
Manip Prof 2		0.83		0.30			0.84
Manip Prof 3		0.91					0.86
Manip Prof 4		0.83		0.20			0.75
OutExp 1	0.38		0.31		0.69		0.74
OutExp 2		0.27	0.45	0.35	0.55		0.70
OutExp 3		0.25	0.77				0.66
OutExp 4			0.88				0.84
OutExp 5			0.87				0.85
OutExp 6			0.58		0.58		0.71
PerEff 1	0.29			0.24	0.22	0.79	0.82
PerEff 2	0.74				0.39		0.73
PerEff 3		0.20		0.33		-0.70	0.68
PerEff 4	0.53	0.46					0.55
PerEff 5	0.77						0.66
PerEff 6	0.81						0.73
PerEff 7	0.76		0.28				0.71
PerEff 8	0.73						0.57
PerEff 9	0.72		0.29	0.31			0.73
Eigenvalue	7.88	3.14	2.45	1.81	1.29	1.06	
Pct Of Var	32.80	13.10	10.20	7.50	5.40	4.40	
Cum Pct	32.80	45.90	56.10	63.70	69.00	73.50	

As part of the overall Technology Scale which was administered to participants, a section relative to barriers to using manipulatives was included. One significant piece of information relative to barriers listed in Table 31 below is that for all participants over the three years, approximately 74% of them do not actually believe barriers of any type exist to their use of manipulatives in the classroom. In Year #3, 63% disagreed or strongly disagreed that any of the barriers listed were actual impediments to their use of them in the class. This was the highest level of agreement that barriers actually existed to the use of manipulatives of either of the two previous groups (Year #1= 75% disagreement; Year #2, 78% disagreement). The mean of the overall group of scores, however, was 2.25 which still overall generally reinforces the idea that participants do not believe that significant barriers listed are impediments to their teaching of mathematics. Year #3 did, however, have the highest mean of all three years, indicating more agreement with the notion of barriers existing than the two previous groups of participants.

In Table 32, barriers are presented for the reader from most significant, as determined by the mean, to least significant. In other words, those barriers which obtained the highest means appear to be those that create the most significant problems for participants relative to use of manipulatives. Specifically, the highest rated barrier across the three years was "that they cost too much (3.48)," which, in the case of teachers which attended this workshop is very significant, as many, if not most, come from schools were resources are quite limited. This barrier was also rated highest by participants of all three years. Further, the barrier "kids don't learn anything with them" was rated generally lower overall. Its rating during the third year was 1.79; its ranking for the second year was 1.42, and its ranking for the first year was 1.45. It seems teachers do, in fact, believe in the use of manipulatives.

Finally, although one interesting test would have been to see if one's scores on Outcome Expectancy and Personal Efficacy on the MUTEBI predicted computer usage in the classroom as measured by the Professional Observation Form (checklist completed by participant raters), this was not performed due to the fact that many, if not most, participants in the project did not

have adequate computer technology available to them at their school sites. Table 33 shows significant intercorrelations between barriers to manipulatives.

Table 31.
Barriers to using Manipulatives Items

5. Which of the following are possible barriers to your greater use of manipulatives in your classroom:	% Selecting						
	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Mean	Std Dev
a. they cost too much money.	2	26	12	47	14	3.48	1.22
b. they take too much time.	0	26	16	40	19	2.55	1.08
c. the students will be too noisy.	2	12	9	50	28	2.48	1.08
d. they take up too much space.	3	12	5	52	28	2.10	1.00
e. I don't have any.	0	3	14	45	38	2.12	1.06
f. my principal doesn't like them.	3	24	2	45	26	1.83	0.80
g. I have to cover the book.	2	17	9	53	19	2.34	1.21
h. clean-up takes too long.	0	0	2	52	47	2.29	1.03
i. the kids don't learn anything with them.	0	0	14	53	33	1.55	2.22
j. parents don't like them.	2	29	10	35	24	1.81	0.66
k. they will get lost, broken, or stolen.	0	24	16	38	22	2.50	1.20
l. the kids are hyper when I have tried to use them in the past.	0	24	16	38	22	2.41	1.09
m. I don't know how to use them.	0	5	2	57	36	1.76	0.73
n. they are not geared to a particular grade level.	2	14	5	48	31	2.07	1.04
o. children only play with them.	0	9	10	55	26	2.02	0.85
p. organizing them is a hassle.	0	22	9	50	19	2.34	1.04
q. storing them is a hassle.	3	21	7	48	21	2.38	1.14
r. children have to learn to use paper and pencil.	2	16	16	48	19	2.33	1.02
s. it takes too much planning time.	3	16	12	50	19	2.34	1.07
t. I like the way I teach, and I don't want to change.	2	5	10	62	21	2.05	0.83
Overall Average——————>	1.30	15.25	9.80	48.30	25.60	2.25	1.07

Table 32
Barriers to using Manipulatives Items Ranked by Mean Rating

5. Which of the following are possible barriers to your greater use of manipulatives in your classroom:	% Selecting						
	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Mean	Std Dev
a. they cost too much money.	2	26	12	47	14	3.48	1.22
b. they take too much time.	0	26	16	40	19	2.55	1.08
k. they will get lost, broken, or stolen.	0	24	16	38	22	2.50	1.20
c. the students will be too noisy.	2	12	9	50	28	2.48	1.08
l. the kids are hyper when I have tried to use them in the past.	0	24	16	38	22	2.41	1.09
q. storing them is a hassle.	3	21	7	48	21	2.38	1.14
g. I have to cover the book.	2	17	9	53	19	2.34	1.21
p. organizing them is a hassle.	0	22	9	50	19	2.34	1.04
s. it takes too much planning time.	3	16	12	50	19	2.34	1.07
r. children have to learn to use paper and pencil.	2	16	16	48	19	2.33	1.02
h. clean-up takes too long.	0	0	2	52	47	2.29	1.03
e. I don't have any.	0	3	14	45	38	2.12	1.06
d. they take up too much space.	3	12	5	52	28	2.10	1.00
n. they are not geared to a particular grade level.	2	14	5	48	31	2.07	1.04
t. I like the way I teach, and I don't want to change.	2	5	10	62	21	2.05	0.83
o. children only play with them.	0	9	10	55	26	2.02	0.85
f. my principal doesn't like them.	3	24	2	45	26	1.83	0.80
j. parents don't like them.	2	29	10	35	24	1.81	0.66
m. I don't know how to use them.	0	5	2	57	36	1.76	0.73
i. the kids don't learn anything with them.	0	0	14	53	33	1.55	2.22
Overall Average——————>	1.30	15.25	9.80	48.30	25.60	2.25	1.07

Table 33.
Significant Correlations Between Barriers to Manipulatives
(n-58)

Barrier	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	OutExp	PersEff
a	1.00																					
b		1.00																				
c	.27*	.35**	1.00																			
d	.29*	.45**	.36**	1.00																		
e	.54**			.38**	1.00																	
f	.27*	.28*	.30*	.33*		1.00																
g		.38**				.35**	1.00															
h		.30*	.47**	.46**			.37**	1.00														
i		.44**		.28*		.31*	.30*		1.00													
j						.27*	.35**		.45**	1.00												
k	.31*		.38**	.41**	.50**			.50**			1.00											
l		.26*	.79**					.44**	.29*	.33*	.40**	1.00										
m				.27*			.37**		.57**				1.00									
n		.45**		.45**	.33*	.27*	.40**	.36**	.62**	.35**	.46**	.28*	.55**	1.00								
o	.33*	.32*	.45**	.37**	.29*	.39**	.30*	.30*	.44**	.54**	.35**	.45**	.26*	.50**	1.00							
p			.33*	.32*	.31*		.30*	.43**			.48**	.45**			.53**	1.00						
q	.36**	.44**	.39**	.73**	.46**			.40**	.28*		.46**		.28*	.38**	.58**	.53**	1.00					
r		.34**	.35**	.41**		.40**	.34*	.29*	.37**		.34**	.30*	.34**	.41**	.38**	.39**	.39**	1.00				
s		.27*		.31*			.45**	.37**	.27*	.27*	.27*	.30*	.40**	.33*	.34**	.56**	.40**	.44**	1.00			
t		.26*	.40**			.33*			.29*		.29*	.42**	.37**	.28*		.27*		.29*	.34**	1.00		
OutExp													.28*								1.00	
PersEff			.32*							.28*		.36**						.32*			.42**	1.00

* significant at alpha .05; **significant at alpha .01

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Table 34 shows a varimax rotated factor matrix on barriers. The same procedure used in the factor analysis of the technology scales was used here. A principal components analysis of the correlation matrix was computed. All factors with eigenvalues equal to or greater than 1.00 were retained and rotated to the varimax criterion. These standards again disclosed six factors. Table 34 displays the rotated factor matrix and associated statistics. To aid in the interpretation of the analysis, only item/factor correlations equal to or greater than .20 (absolute value) were displayed. At the next stage, the focus was on the greatest correlation in each row. The result led to the interpretation that the first factor was a general pedogogical

Table 34.
Varimax Rotated Factor Matrix
Barriers to Using Manipulatives

Item/FACTOR-------->	1	2	3	4	5	6	COMMUNALITY
a. they cost too much money.			0.21		0.78		0.72
b. they take too much time.	0.46	0.58	0.25				0.61
c. the students will be too noisy.		0.34	0.89				0.92
d. they take up too much space.	0.20	0.83			0.25		0.80
e. I don't have any.		0.22		0.22	0.81		0.76
f. my principal doesn't like them.	0.37		0.34				0.34
g. I have to cover the book.	0.50			0.51	-0.21	0.22	0.61
h. clean-up takes too long.		0.52	0.34	0.43			0.61
i. the kids don't learn anything with them.	0.76					0.35	0.77
j. parents don't like them.	0.24					0.86	0.84
k. they will get lost, broken, or stolen.		0.36	0.27	0.38	0.45		0.55
l. the kids are hyper when I have tried to use them in the past.			0.84	0.23		0.23	0.83
m. I don't know how to use them.	0.80						0.73
n. they are not geared to a particular grade level.	0.65	0.38				0.25	0.67
o. children only play with them.	0.23	0.27	0.30	0.24	0.29	0.60	0.72
p. organizing them is a hassle.		0.22	0.26	0.76	0.22		0.79
q. storing them is a hassle.		0.72		0.26	0.41		0.78
r. children have to learn to use paper and pencil.	0.41	0.33	0.23	0.39			0.48
s. it takes too much planning time.	0.33			0.77			0.72
t. I like the way I teach, and I don't want to change.	0.48		0.57	0.26	0.22	-0.37	0.84
Eigenvalue	6.90	1.89	1.64	1.31	1.23	1.13	
Pct of var	34.50	9.50	8.20	6.60	6.10	5.70	
Cum pct	34.50	44.00	52.10	58.70	64.80	70.50	

factor dealing with student's learning styles/needs and professional competency. The second factor was a time/storage factor. Student control was the third factor. The fourth factor was instructional-organization related. The fifth was an acquisition and retention factor, and the

sixth a "lack of seriousness" factor. These factors may be a spring board for further inquiry into the use or lack of use of manipulatives in 6-9 classrooms.

QUESTION #4:

How effective has this project been at increasing teacher capacity to develop instructional units incorporating appropriate mathematical concepts, tools, technology, and instructional strategies? (Objective #4)

Participants from all years were asked to complete a project of their choosing utilizing principles, strategies, pedagogical techniques, etc. gained from this project. As such, 54 participants (Year #1 = 16; Year #2=19; Year #3 = 19) turned in projects which were rated according to salient NCTM St*andards* by Ms. Judy Cantey of Jefferson State Community College in Birmingham, Alabama. A copy of the instrument which was used by Ms. Cantey to rate each project entitled "Implementation Matrix for NCTM Standards" can be found in Appendix B. Ms. Cantey is the NCTM Representative for the Alabama Council of Teachers of Mathematics and the Alabama delegate for the Central Alabama Council of Teachers of Mathematics. Project ratings ranged from a high of 5 (Excellent) to a low of 1 (Poor) on eleven categories which will be discussed regarding Table 39. Appendix C contains information which was given to students relative to project development for each year in order to guide participants' work.

In Table 35, mean ratings of projects by grades are presented showing that the average of all projects was 3.30, with a standard deviation of .30. Further, eighth grade teachers overall received the highest ratings on their units across the project (3.44), while sixth grade teachers across the three years developed projects which received the overall lowest rankings (mean =3.22). However, as can be seen from Table 36, analysis of variance disclosed no significant difference between units of teachers at any grade. It appears the quality of units did not significantly differ from teachers in one grade to the next.

Table 35.
Mean Ratings of Teacher Developed Units By Grade
Project Total

Grade Level	Mean	Std Dev	Cases
All Participants	3.30	0.30	54
Grade 9	3.24	0.31	21
Grade 8	3.44	0.34	17
Grade 7	3.26	0.17	9
Grade 6	3.22	0.23	7

Table 36.
ANOVA of Teacher Developed Units by Grade
for Project Participants

Source	D.F.	Sum Of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	.49	.16	1.90	.14
Within Groups	50	4.28	.09		
Total	53	4.76			n.s.

Table 37 reveals ranges of ratings for student units when viewed in terms of those units using technology versus those not using technology. Projects obtained means which ranged from a low of 2.82 to a high of 4.18 across the three years, while the range for those units not using technology was from a low of 2.64 to a high of 3.64. For all units, the lowest ranked units were 2.64 and the highest ranked units were 4.18. When reviewing the individual yearly reports, it can be seen that Year #3's overall mean for projects was 3.43. These third year participant units were the highest ranked of all the three years. Year #1 overall mean was 3.22, while the overall mean for Year #2 was 3.25.

When viewing the individual yearly reports, for Year #3, the mean rating of participants whose projects included technology is .39 points higher than for those participants whose projects did not include technology. Analysis of variance disclosed a significant difference between those participant units which used technology versus those which did not use technology for Year #3 participants. This was the highest difference in units seen of any of the three years. Year #1 difference between those using and not using technology in their units was .10, while Year #2 difference was .15. Neither of those two differences were significant.

Table 37.
Range of Ratings Assigned to Participant Developed Mathematics Units

Professional Unit Check List	Low	High	N
Units Using Technology	2.82	4.18	27
Units Not Using Technology	2.64	3.64	27
All Units	2.64	4.18	54

Table 38 shows the results of t-testing between student-developed units using technology versus those not using technology. As can be seen, there was a significant difference between those units which included technology versus those which did not.

Table 38.
t-Test of difference Between Participant Developed Mathematics Units Using Technology and Those Not
n=54

Statistics	Yes	No
Mean	3.42	3.19
Variance	0.10	0.05
Observations	27	27
Hypothesized Mean Difference	0	
Df	52	
T Stat	3.06	
Pre- Post-Test Change——	————>	0.23
Standard Deviation	.32	.23

* significant $\alpha \leq .05$

Further, from Table 39, composite ratings of all categories by which each unit was evaluated were computed revealing that for all 54 units turned in, participant units rated highest on the capacity to have students actively participate (mean =3.78), while the lowest ranked unit was "capacity to increase technology skills of students" (2.63). Finally, other qualitative information regarding participant projects can be found in appendices of each of the yearly reports for the interested reader.

Table 39.
Composite Rating of Participant Developed Mathematics Units

Rank	Mean	Item Number And Variable
1	3.78	7. Capacity to have active participation of students?
2	3.54	5. Capacity to assist students in making connection of mathematics to other areas of his/her life?
3	3.46	9. Capacity to facilitate students' use of investigatory/reasoning skills?
4	3.43	4. Capacity to empower students in mathematics?
5	3.41	3. Capacity to help students find mathematics personally meaningful?
6	3.37	2. Capacity to motivate students to share thoughts with teacher and other students?
7	3.28	1. Capacity to help students integrate mathematics into other curriculum areas?
7	3.28	6. Capacity to assist students in using a variety of thinking processes and strategies?
8	3.17	8. Capacity to increase positive student attitudes toward mathematics?
9	3.02	10.Capacity to communicate sensitivity to cultural diversity?
10	2.63	11. Capacity to increase technology skills of students?

QUESTION #5:

How effective has this project been at increasing teacher knowledge of strategies designed to enhance positive student attitudes toward mathematics?(Objective #5)

As can be recalled from demographic and related data reported in the Cumulative Demographic Report, 38% of participants noted using cooperative learning strategies in their classroom prior to this workshop. Further, according to NCTM *Standards*, the ability of students to work together, to be actively involved in their learning process, use manipulatives, etc. and other similar characteristics of the classroom environment appear to lead to more positive student attitudes toward mathematics. In order to attempt to measure student attitudes toward not only the subject of mathematics, but also toward their teachers, an evaluator-developed scale for assessing teachers was built. Further, the Fennema-Sherman Mathematics Scales noted in the earlier chapter were also used to assess student attitudes toward mathematics. *Please recall that during data analysis of these scales for the cumulative overall report, analyses were changed such that 5=Strongly Agree to 1=Strongly Disagree, in contrast to individual yearly reports; therefore, for this report, the higher the rating, the more*

positive students felt about math topics and their teachers. Table 40 displays response frequencies *reported in percents* for the Evaluator-Developed Teacher Assessment Scale.

In Year #1, 370 students were evaluated, in Year #2, 285 students were surveyed, and in the third year, some 412 students were assessed according to attitudes toward math bringing the total number of students evaluating teachers to 1067. The evaluator-developed scale preceded the other four Fennema-Sherman Scales on the instrument itself and consisted of seven items. Cronbach's alpha for this short scale was .82 as can be seen in Table 41.

Table 40.
Evaluator-Developed Teacher Evaluation Scale
N = 58

Item/Response n= 1067	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree
1. I like this math class.	31	38	17	7	7
2. This math teacher helps me to like math better than other math teachers I have had.	30	29	21	12	9
3. This math teacher shows me how to use math in everyday life more than other math teachers.	26	30	26	12	6
4. This math teacher wants me to learn how to solve problems, not just get right answers.	58	29	9	2	2
5. This math teacher lets us actively participate in class.	41	36	14	5	4
6. This math teacher gives us work so that I can learn from other students in my class.	20	30	26	15	11
7. This math teacher let us work on the computer.	19	13	18	19	31
Overall Average ——————>	32.14	29.29	18.71	10.29	10.00

Table 41.
Selected Descriptive Statistics from the Mathematics Attitude Scales

Subscale	Item Mean	Variance	Alpha Reliability	# of Cases
Evaluator-Developed Teacher Scale	2.37	.29	.82	1067
Fennema-Teacher	3.69	.16	.86	1067
Fennema Math Confidence	3.68	.10	.91	1067
Fennema Math Usage	4.00	.04	.87	1067
Fennema Math Success	4.00	.30	.83	1067

Keep in mind when interpreting the student evaluation data below that for purposes of the final cumulative report, data were changed so that 5=Strongly Agree to 1= Strongly Disagree, as was mentioned in describing the instruments. As we can see from the above table, on all

items, except #7, students agreed or strongly agreed more than the disagreed or strongly disagreed. This was the case also in Years #1 and #2; however, Year #3 participants agreed or strongly agreed with all seven items.

Further, when viewing the results of Table 40 as a group, it seems that students would like to have more time on the computer than they do (Question #7 = 50% disagree to strongly disagree). Regardless, however, they did feel positive toward their teachers. Overall, teachers as a group gained the highest ranking on Question #4, which reveals that students apparently do think that these teachers do have their best interest at heart (87% agreed to strongly agreed). This has been true in all yearly reports. The second highest ranked item on this scale was Question #5 which received a relatively high degree of agreement (77%) when students were asked if teachers let them actively participate in class. This was the second highest ranked item throughout the three individually yearly reports also. As a whole, students appeared to like their math classes (69% strongly agreed or agreed - Question #1). Students further answered agree to strongly agree on the following: (a) 59% rated these teachers as helping them to like math more than other teachers they have had previously (Question #2); 56% think these teachers help them to use math in their everyday lives (Question #3); and 50% noted having the opportunity to learn from other students (Question #6).

As noted from Table 41, student ratings appeared equally highest on the Math Usage Scale (4.00) and the Math Success Scale (4.00). The Fennema Teacher Scale (3.69) and the Teacher Confidence Scale (3.68) both computed rather equal item means. Finally, on final cumulative data, the evaluator-developed scale computed a lower mean than any of the others (2.37).

It appears that students do feel that math is important in their lives and they would not avoid the opportunity to be successful in math, as has been true from earlier individual yearly reports. And, it seems that students do generally have favorable impressions of their teachers.

Qualitative data from Exit Interview Question #1 in Appendix E of Years #2 and #3 reports and Appendix D of Year #1 report shows that participants feel the knowledge in the program they gained has facilitated their ability to help students have a more positive attitude toward mathematics. Specifically, gaining more skills at using computers, manipulatives, graphing calculators, and the numerous activities, games, puzzles, etc., together with gaining more confidence in using these instructional resources with which they were acquainted via the project, they believe, has helped their students to be more positive about mathematics. Learning more specifically how to utilize cooperative learning as a teaching techniques was mentioned as being a classroom tool which teachers also believe has increased positive student attitudes toward math. Further, teachers' ability to make math more useful in everyday life, hands-on learning, and small group activities were mentioned as having helped their students gained more confidence in their own ability to perform. Several teachers now say their students like their math classes best.

Table 42 below presents student evaluations by grade for each of the scales mentioned. *In interpreting these scores, again keep in mind that scaling has been changed from individual yearly reports to 5=Strongly Agree to 1= Strongly Disagree, as was mentioned earlier in describing instruments.*

Table 42.
Student Evaluation Scales by Grade Level Taught

Subscale	#	Math	Confi	Math	Succ	Math	Usage	Eval.	Devl.	Teacher	Scale
	Cases	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
All	1067	44.13	10.51	47.97	7.64	47.97	8.53	16.56	5.82	44.34	8.59
Grade 9	426	42.24	10.65	47.34	7.60	46.96	8.75	18.62	6.49	42.69	9.22
Grade 8	331	45.48	10.76	48.83	7.75	48.82	9.05	15.32	5.07	46.06	8.30
Grade 7	179	45.30	10.10	47.36	8.17	48.56	8.01	16.07	5.01	44.47	7.89
Grade 6	131	45.27	9.07	48.72	6.43	48.27	6.69	13.69	3.84	45.15	7.03

Analysis of variance disclosed all subtests mentioned above were significant for differences between grades, as can be seen from the tables 43-47.

Table 43.
ANOVA of Evaluator Developed Scale By Grade

Source	D.F.	Sum Of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	3435.05	1145.02	37.19	.00
Within Groups	1063	32729.43	30.79		
Total	1066	36164.48			

Subsequent Duncan's test disclosed that the sixth grade mean was significantly lower than the means of of the other three grades. Further, the seventh and eighth grade means were significantly lower than grade nine mean.

Table 44.
ANOVA of Teacher Scale By Grade

Source	D.F.	Sum Of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	2234.19	744.73	10.37	.00
Within Groups	1063	76336.03	71.81		
Total	1066	78570.21			

Subsequent Duncan's test disclosed that the grade nine mean was significantly lower than the mean of the other three grades.

Table 45.
ANOVA of Mathematics Confidence By Grade

Source	D.F.	Sum Of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	2534.86	844.95	7.79	.00
Within Groups	1063	115276.03	108.44		
Total	1066	117810.89			

Again, subsequent Duncan's test disclosed that grade nine mean was significantly lower than the means of the other grades.

Table 46.
ANOVA of Mathematics Usage By Grade

Source	D.F.	Sum Of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	740.77	246.92	3.42	.02
Within Groups	1063	76782.01	72.23		
Total	1066	77522.79			

The subsequent Duncan's test disclosed that the grade nine mean was significantly lower than the means of grade seven and eight. No other significant differences were found.

Table 47.
ANOVA of Attitude Toward Mathematics Success By Grade

Source	D.F.	Sum Of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3	555.75	185.25	3.20	.02
Within Groups	1063	61615.52	57.96		
Total	1066	62171.27			

The subsequent Duncan's test disclosed that the means of grade nine and seven were significantly lower than the grade eight mean, but they were not significantly different from each other or the grade six mean.

Table 48 shows ranges of scores obtained by grade for all student evaluation scales. All Fennema-Sherman student evaluation scales was comprised of twelve questions. The Evaluator-Developed scale, however, contained seven questions. All scales ranged from a low of 1=Strongly Disagree to 5=Strongly Agree; therefore, all Fennema scale ranges were from 12 to 60, while the evaluator-developed scale could range from 7 to 35.

Table 48.
Score Ranges of Student Evaluation Subscales

	Math. Confid		Math Success		Math Usage		EvDev Scale		Teacher Scale		# of
	Low	High	Low	High	Low	High	Low	High	Low	High	Cases
All Grades	12	60	12	60	12	60	7	35	12	60	1067
Grade 9	12	60	16	60	12	60	7	35	12	60	426
Grade 8	12	60	20	60	16	60	7	31	17	60	331
Grade 7	17	60	12	60	16	60	7	35	16	60	179
Grade 6	18	60	31	60	31	60	7	25	30	60	131

Because workshops for program participants were held in the summer, it was virtually impossible to perform pre/post-testing of attitudes surveys on students, since most, if not all, teachers had new pupils following the workshop. Further, because of very strict confidentiality guidelines both at UAB and in the various school systems, obtaining student achievement data became difficult. However, in an effort to assess, to some degree, student

achievement, a qualitative instrument developed by the evaluator was designed to investigate participants' perceptions of student achievement in their pupils and was administered to all participants. In the appendices of each of the yearly reports, qualitative data regarding teacher perceptions of student achievement can be found. A synopsis of these findings are as follows: When asked if they believed students were developing a better understanding of math content, the vast majority of participants answered in the affirmative, citing reasons such as students being more involved in their learning, using hands-on approaches, better articulation of math processes, improved test scores, and other teachers who taught students the next year remarking that students had a better knowledge base. When asked if participants had noticed improved performance on classroom measures of math achievement, the majority again answered in the affirmative. Reasons cited were improved test scores, better student understanding of material, more student excitement about math, and hands-on activities such as the computer and manipulatives activities which they believed helped increased performance levels. Further, they believed mathematics retention rate was higher for their students since gaining new skills as a result of their participation in this workshop. They also thought students were better able to think critically through hands-on and group activities, as well as small and large group discussions, better participation in class, and students just seeming to enjoy math more. Finally, when asked if students' standardized test scores had improved, participants from Years #1 and #2 answered they believed they had, although they were not as articulate about the perceived increases. Most of those who did state reasons cited skills gained through this NSF workshop which they believe helped them to be a better, more enthusiastic teacher, with a more positive attitude toward teaching. Third year participants could not answer this question, since the time at which this qualitative instrument was given was prior to the time when most had received standardized test results back.

Finally, under the quantitative section of the Exit Interview presented under Question #6, cumulatively, participants rated this particular aspect of the project--teaching them techniques which could increase positive student attitudes in math-- fourth highest (mean =

4.50). In Year #3, this category was rated third highest (mean =4.42); in Year #2, it was rated third highest (mean = 4.42), while in Year #1, it was rated second highest (mean=4.65).

However, as can be recalled from student-developed units, as a group, participant ratings relative to increasing positive student attitudes toward math gained the third lowest (mean = 3.17). Year #1 mean unit rating in this area was 2.56 (lowest), Year #2 mean was 3.11 (third lowest), and Year #3 mean was 3.32 (again third lowest). It appears that participants appear to believe that this project has given them skills and techniques at improving student attitudes in math; however, putting those skills into practice, in other words, implementing those skills via unit development may be more of a challenge to them.

QUESTION #6:

How effective has this project been at increasing teachers' ability to implement strategies and instructional materials gained through this project? (Objective #6)

Qualitative information included in the appendix of each individual yearly report reveals additional information as they related specifically to projects developed by participants, all of which yielded information regarding implementation of strategies, etc. learned from this project. Although ratings of these projects were included under the discussion of Question #4, specifics on individual projects relative to how much they have been used and how much other units gained from this project have been used are noted here. A "production rate" versus "implementation rate" was calculated for all three years individually and was presented in each yearly report. Specifically, for Year #1, although only 16 participants turned in units, all stated in qualitative data they these units were implemented. Therefore, there was a 80% rate of actual production of units, and a 100% rate of implementation for those who produced units for the project in Year #1. For Year #2, all nineteen participants produced units yielding a production rate of 100%. Of the nineteen who produced units, it was noted that 79% (15 out of 19) of individuals have used their projects in their classrooms. If they had not used them, it was due to the fact that they had gone on leave, had been assigned to another school

where the unit was inappropriate for students, or that the teacher was, at that time, simply not teaching mathematics. For Year #3, all 19 participants turned in units, thus yielding a production rate of 100%, and of the 19 who turned in units, 14 participants have implemented these units, thus yielding an implementation rate of 74%. However, it should be noted that of the five individuals who reported not having used their units, most replied that they haven't covered those topics as of the time of the completion of this qualitiative instrument. Apparently, most intend to use their units before the school year ends. The overall "production rate" of all participants for the three years of this project was 93%, while the overall "implementation rate" for participants across the three years was 84%.

Further, in Year #3, information taken from qualitative data disclosed that 15 of the 19 participants (79%) had implemented other units gained through this project. This was also true in Year #2. Year #1 data showed an implementation rate of 95% (19 participants) relative to other units gained through this project. Of the total 58 participants for the three years, 84% of them have also implemented other units gained from the project.

When asked if they had shared their projects with mentees, in Year #1, participants shared their projects with mentees at a rate of some 75%. However, Year #2 participants appear to have shared their projects with mentees at a lower rate (approximately 40%). Year #3 participants have shared their projects with their mentees at a rate of 58% (11 participants). For the entire project, some 58% of participants across the three years have shared their projects with his/her mentees.

As was noted in earlier yearly reports, the Dunn Teaching Styles Inventory was administered to project participants, with alpha reliabilities presented in Table 49. Caution in interpretation of these scales is dictated by the low reliabilities which may due, in part, to the small sample size.

Table 49.
Dunn Teaching Styles Inventory Reliability Coefficients

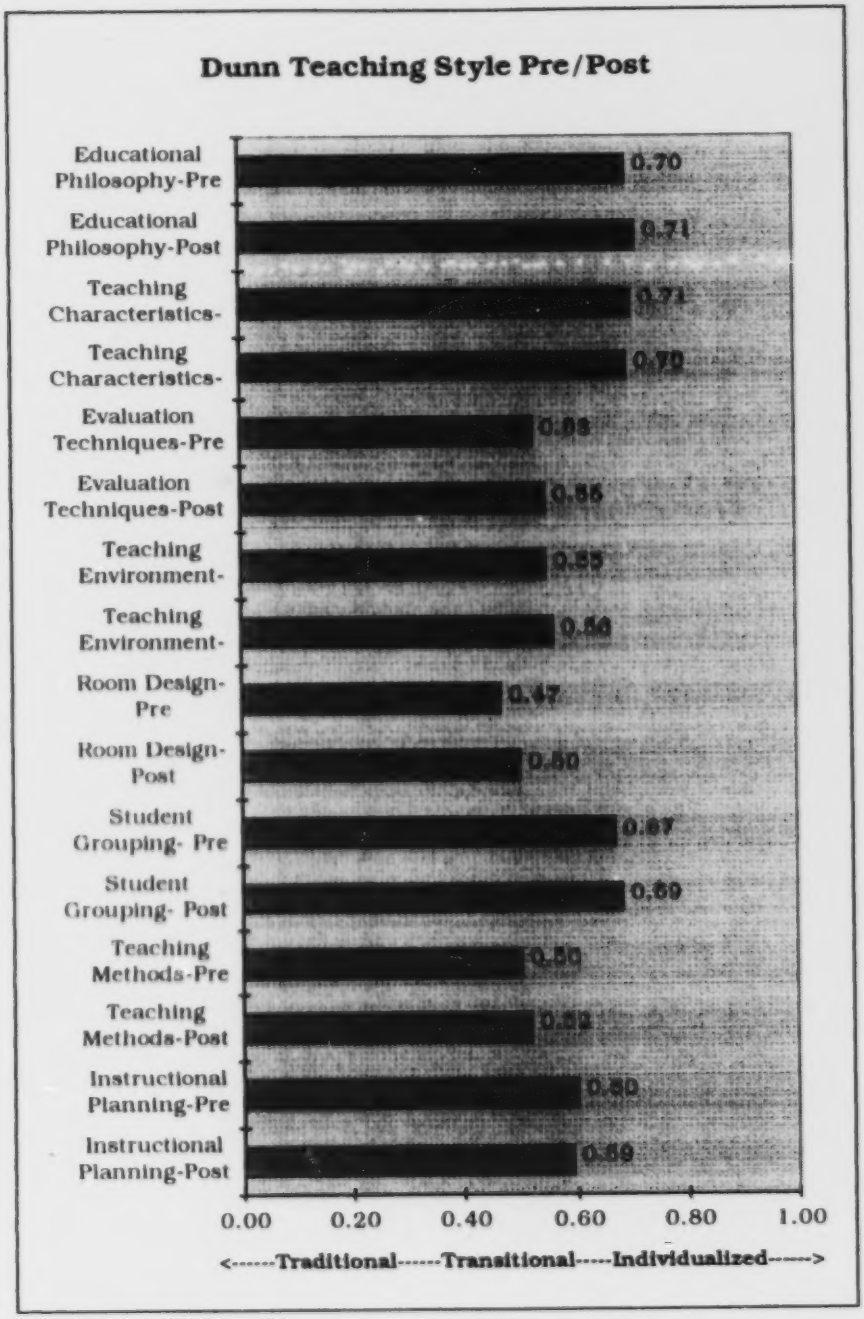
Dunn Teaching Styles Sub Scales	Pre Test Alpha Reliability	Post Test Alpha Reliability	# Items
Instructional Planning	.64	.76	12
Teaching Methods	.00	.40	6
Student Grouping	.35	.40	6
Room Design	.82	.81	6
Learning Environment	.65	.70	7
Evaluation Techniques	.65	.75	8
Teaching Characteristics	.25	.30	8
Educational Philosophy	.55	.74	14
Number of Cases	38	58	

Data which were collected pre/posttest on participants from the Dunn Teaching Styles Inventory are presented in Figure 1. This figure displays average pre/posttest ratings on all eight of the subscales measured by the Dunn Teaching Styles Inventory for all data collected. It should be remembered that for Year #1, only posttest scores were collected; therefore, no t-testing was performed on that year's data. However, Figure 1 includes all pretest information, since they are average pre/posttest ratings. T- Tests were run on all pre/posttest scores gained on the Dunn Teaching Styles Inventory subscales for Years #2 and #3. During Year #2, two subscales – room design and teaching methods– did reveal significance differences at the .05 level; however, no other significant differences were shown at any time during the project.

As can be seen from this chart, cumulatively, educational philosophy (pre/post), teaching characteristics (pre/post), and student groupings (pre/post) all appear to be approaching an "individualized" teaching style. This was true with Year #2 and #3 participants also. Again, as has probably been the case in the previous reports, it may be that the some of the subscales in transition are such because teachers do not maintain ultimate control over some of these variables.

However, as has been the case in both previous years, it does appear that this group of teachers is reasonably open and flexible to classroom interaction and is comfortable with a lesser amount of direct supervision given to students. In other words, these teachers are not afraid to let students become actively involved in their learning.

Figure 1.



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As noted in the evaluation plan relative to Objective #6, participants were to be observed, and as noted earlier under instruments, each teacher was observed by two evaluation professionals midpoint in the project. Each was rated according to a "Classroom Observation Schedule" developed by evaluators which assessed each participant on eleven different categories ranging from 0 = Not Observed to 3 = Very Good.

The t-test, as shown in Table 50, reveals no significant difference between the average rating given by the two observers. In addition a test of the difference in the variability of the two raters was conducted. The results indicated there was no significant difference between the variance in the assigned ratings between the two raters. These results are shown in Table 51. It was concluded from these analyses that the two ratings could be averaged or summed for further analyses. For this report, the two ratings were averaged for the analyses presented below.

Table 50.
t-Test of the Difference Between the Mean Ratings Assigned by the Two Raters

Statistics	Rater #1	Rater #2
Mean	2.03	2.05
Variance	0.11	0.09
Observations	57	57
Pearson Correlation	0.10	
Hypothesized Mean Difference	0	
Df	112	
T Stat	-0.34	
P(T<=T) One-Tail	0.37	
T Critical One-Tail	1.66	
P(T<=T) Two-Tail	0.73	
T Critical Two-Tail	1.98	Difference .02
	Not Significant	Alpha .05

Table 51.
F-test of the Difference Between Rater Variances

Statistics	Rater #1	Rater #2	Average Difference
Mean	2.03	2.05	-0.02
Variance	0.11	0.09	
Observations	57	57	
Df	56	56	
F	1.25		n.s.
P(F<=F) One-Tail	0.20		
F Critical One-Tail	1.56		

Analyses of variance were computed to test the significance of differences between the mean scores obtained on each of the eleven subscales of the scale for each grade level. There was no signficant difference by grade on any of the scales except cultural sensitivity. As such, a Duncan's Multiple Range Test was run on this subscale, with results presented when the subscale is shown below.

However, each subscale average by grade is shown below beginning with reliability coefficients for each subscale shown in Table 52. As can be seen, the reliabilities range from a high of approximately .94 to a low of .40. These reliabilities should caution persons interpreting the meaning of these subscale scores.

Table 52.
Classroom Observation Schedule Subscale Reliabilities

Observation Subscale	Cronbach's Alpha	# Items	# Cases
1. Classroom Climate	.82	11	57
2. Classroom Management	.52	4	57
3a Communication Non-Verbal	.42	5	57
3b. Communication Verbal	.81	3	57
4. Competency And Preparation	.69	9	57
5. Instructional Style	.79	23	57
6. Materials/Equipment	.86	2	57
7. Physical Arrangement	.86	4	57
8. Student/Teacher Interaction	.81	6	57
9. Technology Integration	.94	6	57
10. Time Management	.60	3	57
11. Cultural Sensitivity	.40	3	57

Table 53.
Classroom Climate by Grade
Project Total (# of Items=11)

Grade Level	Mean	Std Dev	Cases
All Participants	24.23	4.54	57.00
Grade 9	23.60	4.46	21.00
Grade 8	25.53	4.28	18.00
Grade 7	22.06	5.41	8.00
Grade 6	24.95	4.21	10.00

Table 54.
Classroom Management by Grade
Project Total (# of Items = 4)

Grade Level	Mean	Std Dev	Cases
All Participants	8.38	2.36	57.00
Grade 9	7.98	2.90	21.00
Grade 8	8.75	1.95	18.00
Grade 7	8.19	1.53	8.00
Grade 6	8.70	2.46	10.00

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Table 55.
Communication Nonverbal by Grade
Project Total (# of Items = 5)

Grade Level	Mean	Std Dev	Cases
All Participants	12.61	1.61	57.00
Grade 9	12.29	1.68	21.00
Grade 8	12.86	1.52	18.00
Grade 7	12.75	1.73	8.00
Grade 6	12.70	1.69	10.00

Table 56.
Communication Verbal by Grade
Project Total (# of Items = 3)

Grade Level	Mean	Std Dev	Cases
All Participants	8.59	0.73	57.00
Grade 9	8.60	0.66	21.00
Grade 8	8.67	0.84	18.00
Grade 7	8.31	0.88	8.00
Grade 6	8.65	0.53	10.00

Table 57.
Competency and Preparation by Grade
Project Total(# of Items = 9)

Grade Level	Mean	Std Dev	Cases
All Participants	21.18	3.48	57.00
Grade 9	20.76	3.35	21.00
Grade 8	21.44	3.50	18.00
Grade 7	20.38	2.79	8.00
Grade 6	22.25	4.32	10.00

Table 58.
Instructional Style by Grade
Project Total (# of Items = 23)

Grade Level	Mean	Std Dev	Cases
All Participants	43.66	8.60	57.00
Grade 9	42.36	9.22	21.00
Grade 8	45.86	7.51	18.00
Grade 7	40.63	10.12	8.00
Grade 6	44.85	7.88	10.00

Table 59.
Materials/Equiptment by Grade
Project Total (# Items = 2)

Grade Level	Mean	Std Dev	Cases
All Participants	3.69	1.92	57.00
Grade 9	3.24	2.17	21.00
Grade 8	4.28	1.79	18.00
Grade 7	3.75	1.39	8.00
Grade 6	3.55	1.92	10.00

Table 60.
Physical Arrangement by Grade
Project Total (# of Items = 4)

Grade Level	Mean	Std Dev	Cases
All Participants	10.11	1.50	57.00
Grade 9	9.69	1.40	21.00
Grade 8	10.42	1.43	18.00
Grade 7	9.44	1.27	8.00
Grade 6	10.95	1.64	10.00

Table 61.
Student/Teacher Interaction by Grade
Project Total (# of Items = 6)

Grade Level	Mean	Std Dev	Cases
All Participants	14.88	2.85	57.00
Grade 9	13.69	3.37	21.00
Grade 8	15.86	1.62	18.00
Grade 7	15.13	1.81	8.00
Grade 6	15.40	3.47	10.00

Table 62.
Technology Integration by Grade
Project Total (# of Items = 6)

Grade Level	Mean	Std Dev	Cases
All Participants	1.74	4.25	57.00
Grade 9	1.74	4.22	21.00
Grade 8	0.83	3.18	18.00
Grade 7	1.19	2.64	8.00
Grade 6	3.80	6.44	10.00

Table 63.
Time Management by Grade
Project Total (# of Items = 3)

Grade Level	Mean	Std Dev	Cases
All Participants	7.74	1.58	57.00
Grade 9	7.79	1.52	21.00
Grade 8	8.03	1.56	18.00
Grade 7	7.06	1.76	8.00
Grade 6	7.65	1.65	10.00

Table 64.
Cultural Sensitivity by Grade
Project Total (# of Items = 3)

Grade Level	Mean	Std Dev	Cases
All Participants	4.65	1.85	57.00
Grade 9	4.93	1.27	21.00
Grade 8	3.61	1.95	18.00
Grade 7	3.88	1.53	8.00
Grade 6	6.55	1.34	10.00

As mentioned above, analysis of variance was performed on all subscales, with the only one signfiicant -- cultural sensitivity -- being shown in Table 65. The subsequent Duncan's Multiple Range Test disclosed that the eighth mean was significantly lower than the means of Grades

nine and six. Both grades nine and seven means were lower than the grade six mean. There were no other differences between pairs of means.

It should be noted from Table 62 that lack of equipment was a significant barrier to technology integration in the schools. This lack of equipment is what accounts for the low scores received on this particular subscale.

Table 65.
ANOVA of Cultural Sensitivity By Grade

Source	D.F.	Sum Of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	3.00	61.96	20.65	8.45	0
Within Groups	53.00	129.50	2.44		
Total	56.00	191.50			

At the conclusion of this project, participants were asked to rate the impact of different components of this program shown in Table 66. This table shows frequencies, means, and standard deviations for the twelve items included on the quantitative section of this instrument, with each item tying back to the NCTM *Standards*.

Table 67 presents this same instrument in order of mean ratings, moving from items receiving the highest mean ratings to those receiving lower ratings. Again, a Likert Scale (1= Strongly Disagree to 5 = Strongly Agree) was used. By scanning this table, one can see that participants felt this workshop was effective in meeting their needs overall. The cumulative overall rating of the project, according to this instrument, was 4.32 (above average) with a standard deviation of .63. Further, participants apparently felt this project had best helped them to develop additional ways to make mathematics more meaningful to students, as this category received the overall highest average ranking (mean =4.59). Following very closely behind the highest ranked category with a mean of 4.55 was the category of "I have gained more confidence and skill at using computers, manipulatives, and other technology aids as a result of participating in this workshop." The category which received the lowest overall ranking was that "by participating in this project, I find that I am more sensitive to cultural/socioeconomic differences in my students" which received an overall cumulative ranking of 3.41, or average.

Table 66.
Participants' Quantitative Exit Interview Results
n=58

Item Responses in Percents & Means And Standard Deviations/Items	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Mean	Std Dev
1. This project has helped me to develop new ways of assisting students to integrate mathematics into other areas of their curriculum.	31	59	10	0	0	4.21	0.61
2. This project has helped me to develop new techniques to motivate my students to share their thought processes with me and the other students in class.	43	50	7	0	0	4.36	0.61
3. This project has helped me to develop additional ways to make mathematics more meaningful to my students.	62	35	3	0	0	4.59	0.56
4. By going through this NSF project at UAB, I have gained new ideas and techniques that I can use to assist students in feeling more in control of their success in mathematics.	53	45	2	0	0	4.52	0.54
5. By participating in this project, I find myself encouraging and reinforcing students to justify their solutions and thinking processes in a variety of ways as opposed to only a single way.	48	48	3	0	0	4.45	0.57
6. Through this project, I have learned new ideas about how to give students opportunities to connect what they learn in my class to other areas of their lives.	35	59	5	2	0	4.26	0.64
7. As a result of participating in this project, I have gained new techniques for assisting my students in being more active learners.	45	50	5	0	0	4.40	0.59
8. By going through this project, I now give my students more opportunities to investigate, find their own solutions, and justify their answer.	40	48	12	0	0	4.28	0.67
9. Through this project, I have gained new techniques and ideas regarding increasing positive student attitudes toward math.	55	40	5	0	0	4.50	0.60
10. As a result of participating in this project, I give my students more opportunities to acquire good reasoning skills.	41	47	12	0	0	4.29	0.68
11. By participating in this project, I find that I am more sensitive to cultural/socioeconomic differences of my students.	10	36	38	16	0	3.41	0.88
12. I have gained more confidence and skill at using computers, manipulatives, and other technology aids as a result of participating in this project.	60	35	5	0	0	4.55	0.60
Overall Average---------->	43.58	46.00	8.92	1.50	0.00	4.32	0.63

Table 67.
Exit Interview Items Ranked by Mean
(N=58)

Item Responses in Percents & Means and Standard Deviations/Items	Mean	Std Dev
3. This project has helped me to develop additional ways to make mathematics more meaningful to my students.	4.59	0.56
12. I have gained more confidence and skill at using computers, manipulatives, and other technology aids as a result of participating in this project.	4.55	0.60
4. By going through this NSF project at UAB, I have gained new ideas and techniques that I can use to assist students in feeling more in control of their success in mathematics.	4.52	0.54
9. Through this project, I have gained new techniques and ideas regarding increasing positive student attitudes toward math.	4.50	0.60
5. By participating in this project, I find myself encouraging and reinforcing students to justify their solutions and thinking processes in a variety of ways as opposed to only a single way.	4.45	0.57
7. As a result of participating in this project, I have gained new techniques for assisting my students in being more active learners.	4.40	0.59
2. This project has helped me to develop new techniques to motivate my students to share their thought processes with me and the other students in class.	4.36	0.61
10. As a result of participating in this project, I give my students more opportunities to acquire good reasoning skills.	4.29	0.68
8. By going through this project, I now give my students more opportunities to investigate, find their own solutions, and justify their answer.	4.28	0.67
6. Through this project, I have learned new ideas about how to give students opportunities to connect what they learn in my class to other areas of their lives.	4.26	0.64
1. This project has helped me to develop new ways of assisting students to integrate mathematics into other areas of their curriculum.	4.21	0.61
11. By participating in this project, I find that I am more sensitive to cultural/socioeconomic differences of my students.	3.41	0.88
Overall Average——————>	4.32	0.63

QUESTION #7:

How effective has this project been at developing a viable "Teachers Helping Teachers Network" that is meaningful to both mentor and mentee?(Objective #7)

Two basic sections to this objective regarding evaluation are -- (a) did the mentee feel he/she grew professionally as a function of participating in this project; and (b) how did the mentee and mentor feel about this facet of the project?

The first question -- did the mentee feel he/she grew professionally as a result of participating in this project was assessed through an evaluator-developed instrument which corresponds to the "Exit Interview." Mentees were asked to rate the extent to which they felt this project had aided them in their professional development. Questions placed on this quantitative assessment were again taken from NCTM *Standards*. As can be seen from the

information presented in the table below, mentees rated various elements of the project differently.

Table 68 presents results of the quantitative mentee evaluation. The response return rate for the three years was 72% (42 mentees out of 58 possible responding). Specifically, for Year #3, 17 mentees responded producing a response rate of 89%; for Year #2, 14 mentees responding producing a response rate of 74%; and for Year #1, 11 mentees responded producing a response rate of 55%. Table 69 presents mentee evaluations in terms of mean ratings of items on the scale from highest to lowest (n=42).

Table 68.
Mentee Evaluations
Frequency of Responses in Percents, Means and Standard Deviations

	5	4	3	2	1		
Frequencies On Percents/Items	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree	Mean	Std Dev
1. develop new ways of assisting students to integrate mathematics into other areas of their curriculum.	31	50	14	5	0	4.07	0.81
2. develop new techniques to motivate my students to share their thought processes with me and the other students in class.	38	52	12	0	0	4.24	0.66
3. develop additional ways to make mathematics more meaningful to my students.	50	50	0	0	0	4.50	0.51
4. gain new ideas and techniques that I can use to assist students in feeling more in control of their success in mathematics.	45	41	12	2	0	4.29	0.77
5. encourage and reinforce students to justify their solutions and thinking processes in a variety of ways as opposed to only a single way.	43	50	2	5	0	4.31	0.75
6. learn new ideas about how to give students opportunities to connect what they learn in my class to other areas of their lives.	41	48	7	5	0	4.24	0.79
7. gain new techniques for assisting my students in being more active learners.	48	50	2	0	0	4.45	0.55
8. give my students more opportunities to investigate, find their own solutions, and justify their answer.	36	52	7	5	0	4.19	0.77
9. learn new techniques and ideas regarding increasing positive student attitudes toward math.	36	52	7	5	0	4.19	0.77
10. give my students more opportunities to acquire good reasoning skills.	38	57	2	2	0	4.31	0.64
11. be more sensitive to cultural/socioeconomic differences of my students.	29	38	29	5	0	3.90	0.88
12. gain more confidence and skill at using computers, manipulatives, and other technology aids as a result of participating in this project.	41	50	5	5	0	4.26	0.77
Group Average---------->	39.50	49.17	8.25	3.25	0.00	4.25	0.72

Table 69.
Mentee Evaluations Ranked by Mean Rating

	5	4	3	2	1		
Frequencies On Percents/Items	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree	Mean	Std Dev
3. develop additional ways to make mathematics more meaningful to my students.	50	50	0	0	0	4.50	0.51
7. gain new techniques for assisting my students in being more active learners.	48	50	2	0	0	4.45	0.55
5. encourage and reinforce students to justify their solutions and thinking processes in a variety of ways as opposed to only a single way.	43	50	2	5	0	4.31	0.75
10. give my students more opportunities to acquire good reasoning skills.	38	57	2	2	0	4.31	0.64
4. gain new ideas and techniques that I can use to assist students in feeling more in control of their success in mathematics.	45	41	12	2	0	4.29	0.77
12. gain more confidence and skill at using computers, manipulatives, and other technology aids as a result of participating in this project.	41	50	5	5	0	4.26	0.77
2. develop new techniques to motivate my students to share their thought processes with me and the other students in class.	36	52	12	0	0	4.24	0.66
6. learn new ideas about how to give students opportunities to connect what they learn in my class to other areas of their lives.	41	48	7	5	0	4.24	0.79
8. give my students more opportunities to investigate, find their own solutions, and justify their answer.	36	52	7	5	0	4.19	0.77
9. learn new techniques and ideas regarding increasing positive student attitudes toward math.	36	52	7	5	0	4.19	0.77
1. develop new ways of assisting students to integrate mathematics into other areas of their curriculum.	31	50	14	5	0	4.07	0.81
11. be more sensitive to cultural/socioeconomic differences of my students.	29	38	29	5	0	3.90	0.88
Group Average---------->	39.50	49.17	8.25	3.25	0.00	4.25	0.72

By scanning Table 69, one can see that mentees felt this workshop was effective in meeting their needs in basically all areas rated. The overall mean average for all mentees who responded was was 4.25, with a standard deviation of .72. Mentees ranked their interaction with this project highest in the following areas: (a) developing additional ways to make math more meaningful to students (4.50); and, (b) gaining new techniques for assisting students in being

more active learners (4.45). The lowest ranked category by mentees across the three years dealt with learning skills which would help them be more sensitive to cultural/socioeconomic differences in students, which was received an overall mean rating of 3.90, still above average, however.

In terms of the involvement of mentees in this project, and has been noted in earlier individual yearly reports, it is reasonable that these items would have received a high rating since these are activities in which mentor and mentee can engage at the school level, probably more easily than some of the other items listed.

Qualitative evaluations regarding what ***mentees*** thought about the project and how mentors perceived this mentor-mentee relationship reveal that mentees thought they had grown professionally from their participation in this project. Across all three years, mentees felt the sharing of ideas, the networking of professionals, and the support system being involved in this project had provided was beneficial to them. The challenge of working in a project such as this was mentioned, as well as the fact that the gaining of new, up-to-date information and teaching practices appeared important. Many noted they would like to have had more contact with their mentors ranging from more time in the project to more time in school, and specifically possibly having been involved during the summer workshop would have been beneficial. Some felt this relationship had helped them more accurately assess the own strengths and weaknesses, while others felt that gaining better technology skills had benefitted them greatly. Being able to better communicate among other faculty at the school level was an interesting by-product mentioned by some mentees.

Relative to how participation in this project had aided them professionally, some noted gaining more up-to-date teaching methods and new ideas for motivating students. Helping them to become more "open-minded" about various teaching techniques, gaining a "fresh perspective" and better knowledge of technology were other comments. Further, gaining more confidence in their own ability to teach, to interact with other math teachers, and gaining additional skills at using cooperative learning effectively were mentioned. One person noted

gaining a better understanding of the "team teaching" approach. And, when asked to list skills learned from this relationship, myriad techniques, strategies, etc. were listed again from mentees across the three years, all of which can be found in the appendices of each of the individual yearly reports.

Qualitative information regarding what *mentors* thought of this relationship also seemed positive. Mentors, like mentees, liked the opportunity to share with others in the school. It increased communication between themselves and others which encouraged collaborative problem solving, team work, and networking. Some thought it was a constructive way to begin dialogue with others in their schools. Further, they liked the sharing of materials, working toward common goals, and the excitement of seeing their mentee learn new teaching techniques. Many of them too, as was the case with mentees, would like to have had more time to interact with each other. It was mentioned that choosing a mentee from a feeder school could have been helpful to facilitate downward dispersion of ideas.

When asked how this relationship has helped mentors professionally, comments relative to increasing communication in the schools was cited frequently. Further, it helped them become more organized, efficient, confident, assertive, and better able to reach out to fellow teachers for assistance. It aided some in keeping abreast and incorporating technology and manipulatives in instruction. Some developed new professional relationships. When asked what they would change about the mentor-mentee relationship, the majority of the comments centered around involving the mentee earlier, perhaps toward the end of the summer workshop.

Finally, when asked what ideas, equipment, instructional aids, etc. had they shared with their mentees, many and varied examples of sharing, communication, and professional interaction were listed and can be noted from Appendices of the individual yearly reports.

QUESTION #8:

How effective has this project been at increasing teacher sensitivity toward students' diverse learning styles, particularly minority underrepresented groups?

On two previously mentioned scales, reference has been made to assessment of teacher sensitivity to cultural differences. As can be recalled, under Objective #4, teacher projects (units) were rated according to eleven different categories, with one being "capacity to communicate sensitivity to cultural diversity." The overall cumulative mean project ranking relative to this category was 3.02, or average. Specifically, for Year #1 participants, this category received the second highest composite ranking of all eleven (3.56); for Year #2 participants, this category on student-developed units received the second lowest overall rating (3.00). For Year #3, this category again received the second lowest rating on student-developed units, receiving a mean of 3.05.

Second, relative to the quantitative part of the Exit Interview mentioned under Objective #6, participants themselves were asked to rate how effective this project had been at communicating this concept. Overall for the three years, it received the lowest ranking on the quantitative section of the Exit Interview, with the cumulative mean being 3.41, as can be seen in Table 67. And, in each individual yearly report, participants ranked this category lowest on this evaluation instrument. Overall, 46% of individuals agreed or strongly agreed that this project had assisted them in being more sensitive to cultural/socioeconomic differences in students. This particular category on the Exit Interview quantitative section revealed that some 38% of project participants across the three years were uncertain as to how to evaluate this category, as seen in Table 66.

Last, relative to quantitative assessment of cultural sensitivity, mentees also gave this category the lowest overall ranking for the project, as can be seen from Table 69 where this category received a mean rating of 3.90. and a standard deviation of .88. Mentees from all three years rated this category lowest.

Qualitative information regarding skills acquired that address cultural sensitivity was also gathered from the Exit Interview, Question #2. Participants cited skills at using manipulatives, computers, and graphing calculators as helping, since many of their students are not exposed to their resources at home. Further, using cooperative learning was mentioned as helping students who are culturally disavantaged. Others didn't feel students should be taught any differently, and that by using hands-on activities, this could more readily address the disparity between cultures and environments. One participant mentioned that by being involved with other teachers who teach culturally disadvantaged students, her own awareness of the importance of this concept was reaffirmed.

During the course of this project, each participant was administered a learning styles inventory (Dunn Learning Styles Inventory) as well as the personality preference inventory mentioned earlier (Myers-Briggs Type Indicator), the idea being that if participants knew more about themselves and their own learning styles and personality preferences, they might be more sensitive to students' learning styles and personality preferences. Table 70 shows results of the Myers-Briggs Type Indicator according to preferences for all participants. And, as can be seen, approximately one-third of project participants were of the "ISTJ" preference, which, is also common among mathematicians. Further, the "STJ" preference accounted for approximately 54% of all participants in this project. Table 71 shows how these eight different polarizations -- Introversion, Extraversion, Sensing, Intuition, Thinking, Feeling, Judging, and Perception correlated with student evaluations.

Table 70.
Preferences Displayed on Myers-Briggs by Participants

Myers Briggs		
Type	Frequency	%
ISTJ	20	35
ESTJ	11	19
ISFJ	8	14
ENTJ	5	9
ESFJ	4	7
INTJ	4	7
ENFJ	2	3
ENFP	1	2
ENTP	1	2
INFP	1	2
ISTP	1	2

Table 71.
Correlations of Myers-Briggs with the Teacher Evaluation Scales
Project Total

	Extrav	Introv	Sens	INtui	Think	Feel	Judgm	Percept	Ev.Dev.	TeachSc	MathConf	MathUsage	Mathsuc
Extraversion	1.00												
Introversion	-.58**	1.00											
Sensing			1.00										
INtuition			-.56**	1.00									
Thinking					1.00								
Feeling					-.46**	1.00							
Judgment							1.00						
Perception				.42**		.40**	-.36**	1.00					
Eval. Developed	-.30*								1.00				
Teacher Scale	.29*								-.81**	1.00			
MathConfidence	.43**								-.56**	.73**	1.00		
MathUsage									-.53**	.75**	.79**	1.00	
MathSuccess									-.48**	.76**		.78**	1.00

* significant at alpha .05; **significant at alpha .01

As can be seen from Table 71, it appears that the more extraverted the teacher was across the project, the higher ratings he/she received from students (Teacher Scale), and apparently the more confident student were in their abilities to learn math (Math Confidence). Factor analysis can again assist here; therefore, Table 72 shows a correlation matrix of the Myers-Briggs polarities with sex. The same procedure used in the previous two factor analyses was used here. A principal components analysis of the correlation matrix was computed. All factors with eigenvalues equal to or greater than 1.00 were retained and rotated to the varimax criterion. These standards disclosed four factors, as seen in Table 72 which displays the rotated factor matrix and associated statistics. To aid in the interpretation of the analysis, only item/factor correlations equal to or greater than .20 (absolute value) were displayed. At the next stage the focus was on the greatest correlation in each row. And, as can be seen from Table 72, results of this analysis add confirmatory evidence of what is professed by the Myers-Briggs developers, specifically, there are four dimensions representing eight polarities; however, sex appears to be rather equally split between factors 1 (Sensing-Intuition) and 4 (Judgment-Perception).

Table 72.
Factor Analysis of the Correlation Matrix Composed of
Myers-Briggs Polarities and Sex

Variables	Factor 1	Factor 2	Factor 3	Factor 4	Communality
Extraversion			**-0.88**		0.81
Introversion			**0.89**		0.81
Sensing	**-0.81**				0.70
INtuition	**0.86**				0.77
Thinking		**-0.81**			0.66
Feeling		**0.87**			0.77
Judgment				**0.84**	0.73
Perception	0.42	0.40		**-0.54**	0.65
SEX	0.49			0.49	0.52
EIGENVALUE	2.25	1.65	1.31	1.21	
PCT OF VAR	25	18	15	13	
CUM PCT	25	43	58	71	

When participants were asked on the qualitative section of the Exit Interview if, and how, this project has helped them to become a better teacher, several participants noted having modified their teaching style as a result of their involvement in this workshop. They report now being more "student centered" versus previously being "teacher centered." They reported an increase in motivation by renewing their interest in the level of math they teach. They use technology and manipulatives more now, are more comfortable and confident with computers and other instructional resources, and have a better base of content knowledge. And, finally, they report having learned new ways to make math "fun" for students which has improved both student and teacher attitudes.

In conclusion, five focus groups were held with participants representing each of the three years of the projects being involved in order to gain more indepth information relative to how participants felt about this project. Leaders of these focus groups were evaluators and mathematics specialists in the field, all of whom produced formal reports for this project. Four specific questions were asked: (1) What do you believe were the successes of this project and your participation in it; (2) How has this project facilitated your growth as a professional; (3) What have been some of the barriers to your being able to implement what you have learned in this project in your class or your school; and (4) Do you plan to continue your development as a mathematics teacher, and if so, how? Relative to *Question #1*, participants believed there were many successes of this project, including gaining new (or additional) skills at using technology, increased enthusiasm of teachers, more teacher confidence in the classroom, better support from administrators, new and fresh perspectives on teaching, challenging work which aided participants in again knowing what is was like to be a "student," and overcoming fear in using certain teaching tools and methodologies. Relative to *Question #2*, participants believe this project facilitated their professional growth by increasing their teacher self-esteem and confidence, locating age-appropriate materials for students which made their more able to be proficient at their jobs, gaining skills at working to include administrators early on in the introduction and implementation of new teaching practices, better and more assertively

confident teaching style, better communication with other teachers, opportunities to increase skills at working in teams, and just generally giving some a "jump start" that was needed. When discussing *Question #3*, participants appear to have been in agreement on the general barriers to their successful implementation of teaching tools, methodologies, etc. gained from this project. Specifically, they noted money, time, lack of equipment or poor and outdated equipment, incompatibility of equipment, overcrowded classrooms, a general "space" issue, and a lack of good solid preparation by elementary teachers who prepare students for middle school academic work. Finally, relative to *Question #4*, when asked if participants planned to continue their professional development as a mathematics teacher, many wanted to gain additional skills at using the computer and more manipulatives. Others are attending more professional meetings, while others want to move into curriculum development or expand their grant-writing skills. Some are continuing with postgraduate work as a result of the credits they earned through this program.

IV. Summary and Conclusions

This three year project, set to accomplish eight objectives, appears to have been successful at accomplishing the vast majority of these eight endeavors. Across the three years and fifty-eight participants, significant gains in content knowledge both in Algebra/Probability and Statistics and Geometry were made, as noted specifically under Objective #1. As a matter of fact, only Year #3 participants failed to show a significant gain in Algebra/Probability and Statistics. In all other years both in Algebra and Geometry, significant gains were noted. Sixth grade teachers particularly profited from this project, both in Algebra and Geometry. It appears the project staff was successful in imparting the information needed in order for participants to make necessary progress.

Secondly, it appears that, as a group, participants across the three years gained more confidence in their own ability to use computers effectively in the classroom, and as a result of this increased confidence, they are more willing to take personal responsibility for their students' ability/inability to utilize computers. Participants over the course of this project

became more computer literate as well as more proficient at using manipulatives and other technology tools used to effectively teach mathematics. And, although barriers to using manipulatives do exist, participants did not appear to be greatly encumbered by them. However, for research purposes, general barrier factors were sufficiently identified in global terms such that additional study may now take place to develop appropriate mechanisms for minimizing barriers to using manipulatives.

Participants gained skill and feedback at producing products specifically utilizing technology or other teaching methodologies which can be used to assist in facilitating positive student attitudes toward mathematics. However, it did appear that those units incorporating technology were at least rated significantly different in some way from those not utilizing technology.

It seems that teachers, as a group, gained relatively high teacher evaluations after participating in this workshop; however, we can't attribute these evaluations to the workshop intervention, since pretest comparisons were unavailable. Ninth grade teachers generally gained the lowest evaluations, which could, in part, be due to difficulty level of classes or even to the age group of students. Further, ninth grade students' math confidence level and math attitudes were lower, as was their feeling about the usefulness of math.

As an entire group, teaching styles did not appear to change significantly. However, during Year #2, some significant changes were noted in Room Design and Teaching Methods. Teachers' educational philosophy, teaching characteristics, and student groupings across the years appeared to stay relatively stable, as all from year to year approached an "individualized" approach. Numerous other teaching styles scales were in transition, again understanding that in many instances, teachers' educational philosophy was more individualized than they were actually able to exhibit in the classroom because of extraneous influences.

Upon direct observation, as a group, teachers appeared competent in teaching their subject matter and used teaching strategies designed to maximize classroom learning of students.

However, lack of equipment was observed by evaluators as being a serious obstacle to implementing new strategies gained from this project.

Teachers felt this project helped them most in gaining additional ways of making mathematics more meaningful to their students; and as a by-product in some instances, these new skills revitalized them in their profession. Teachers further felt they gained more skill and confidence in using technologies presented in this program, and as a result, numerous of them indicated they were proceeding further with additional training, education, etc.

By and large, it appears this project was successful; however, if replicated, additional work might be indicated in the areas of (a) the mentor-mentee relationships; and (b) cultural sensitivity. Specifically, numerous mentors and mentees alike desired to spend more time together, either during the summer workshop or at followup sessions, since their school interaction was limited. Further, some participants felt the area of cultural sensitivity was not sufficiently stressed, and if reproduced, additional time and effort might be utilized in approaching this subject.

It does appear, at least to some extent, that personality preferences of the teacher play some role in the teaching of mathematics, and although some *very* preliminary work was performed through this project, additional work in this area is indicated.

In closing, according to one of the focus group reports, "it seems that issues regarding access to sufficient computers, compatibility among operating systems, and support from peers and administrators must be addressed before the greatest benefits from this program can be realized."

V. Endnotes

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APPENDIX A

APPENDIX A

Evaluation Plan

Objective #1

OBJECTIVE	ACTIVITY
Each teacher will have acquired increased knowledge of appropriate concepts in the following areas: A. Pre-algebra B. Pre-Geometry C. Probability and Statistics	Objective #1 will be met through the Workshop which will include the following: A. Formal classroom instruction in content of mathematical concepts

EVALUATION PROCEDURE	
Process: This section of the evaluation will include the following:	
A. A detailed syllabus including instructional objectives outlining content and procedures pertinent to each area presentation will be developed.	B. An evaluation instrument will be developed based on the syllabus. This instrument will be designed to measure the adequacy of content coverage and presentation's use of technology as seen by the teachers and project staff.
C. A pre-test measure will be given to access the status of the knowledge of incoming teachers.	D. A survey of teacher satisfaction will be used to evaluate the project presentations, materials, and other aspects of the workshop environment.
Outcome: Teacher growth will be assessed through a cognitive test over the concepts presented from each unit.	

APPENDIX A (cont.)

Evaluation Plan

Objective #2

OBJECTIVE	ACTIVITY
Each teacher will demonstrate proficiency in the use of selected technologies.	Objective #2 will be met through the Workshop which will include the following: A. Formal classroom presentation(s) and demonstrations. B. Instruction will be combined with "hands-on" experience with computers, computer software, computer graphics, games, programmable calculators, and manipulatives.
EVALUATION PROCEDURE	
Process evaluation for this objective will be as follows:	
A. A detailed syllabus including instructional objectives outlining content and procedures relative to the introduction of technology into the teaching of middle school mathematics will be developed.	B. An evaluation instrument will be developed based on the syllabus. This instrument will be designed to measure the adequacy of which instruction on use of selected technologies agrees with objectives of the syllabus.
C. A survey of teacher satisfaction will be used to evaluate the project presentations, materials, and aspects of the workshop environment relative to the teaching of use of selected technologies.	
Outcome: Each participant's ability to apply selected technologies will be assessed through use of a checklist and a cognitive instrument.	

APPENDIX A (cont.)

Evaluation Plan

Objective #3

OBJECTIVE	ACTIVITY
Each teacher will demonstrate knowledge of instructional skills in applying technology appropriate to middle grade mathematics students.	Objective #3 will be met through the Workshop to include the following: A. Formal classroom instruction in methods of teaching mathematics. B. Laboratory sessions giving practical experience in the methods taught.
EVALUATION PROCEDURE	
Process evaluation for this objective will include the following:	
A. A detailed syllabus including instructional objectives outlining content and procedures pertinent to the teaching of application of technology to middle school students will be developed.	B. An evaluation instrument will be developed based on the syllabus. This instrument will be designed to measure the adequacy of content coverage and the presentation's use of technology as seen by the teachers and project staff.
C. A survey of teacher satisfaction will be used to evaluate the project presentations, materials, and other aspects of the workshop environment relative to acquisition of instructional skills related to the application of technology.	
Outcome: A cognitive assessment covering the application of instructional technologies to the teaching of middle school students will be developed.	

APPENDIX A (cont.)

Evaluation Plan

Objective #4

OBJECTIVE	ACTIVITY
Each teacher will develop at least one instructional unit incorporating mathematical concepts, tools, technology, and instructional strategies.	Objective #4 will be met through the Workshop, specifically Participant Presentations, and Follow-Up in the following manner: Each participant will develop an instructional unit stressing the integration of newly acquired mathematics concepts in pre-algebra, pre-geometry, or probability/statistics.

EVALUATION PROCEDURE	
Process: Process evaluation will consist of a survey of teacher satisfaction which will be used to evaluate this aspect of the Workshop to include adequacy of this pedogogical method to the production of a viable instructional unit.	
Outcome: Outcome evaluation of this objective will include the following:	
A. An implementation matrix developed to monitor the degree to which the student's unit is congruent with the NCTM and Alabama state mathematical standards and objectives.	B. A checklist developed to monitor the presence of salient dimensions of a professionally endorsed teaching unit.

APPENDIX A (cont.)

Evaluation Plan

Objective # 5

OBJECTIVE	ACTIVITY
Each teacher will demonstrate knowledge of strategies for increasing positive student attitudes toward mathematic by the incorporation of these strategies into his/her instructional unit.	Objective #5 will be met through the Seminars and Follow-Up to include the following: A. incorporating in units strategies for "engineering individual student success" to include techniques for aiding students in self discipline, goal setting, and related aspects of achievement motivation. B. incorporating in units role models appropriate to enhancing positive student attitudes toward mathematics.

EVALUATION PROCEDURE

Process: Process evaluation will include the following:

A. A detailed syllabus including instructional objectives outlining content and procedures instrumental to increasing positive student attitudes toward mathematics.

B. An evaluation instrument will be developed based on the syllabus. This instrument will be designed to measure adequacy of coverage and presentation's incorporation of these strategies.

C. A survey of teacher satisfaction will be used to evaluate seminar presentations, materials, and other aspects.

Outcome: Outcome evaluation for this objective will include the following:

A. The syllabus for the unit will be evaluated for the presence of techniques suggested in the seminar.	B. A cognitive measure of the acquisition of knowledge of the techniques presented in the seminar will be administered.
C. The unit chosen for presentation/implementation will be observed for the use of suggested strategies.	D. An affective instrument will be administered to students before and after instruction to determine attitudinal changes toward mathematics.

APPENDII A (cont.)

Evaluation Plan

Objective #6

OBJECTIVE	ACTIVITY
Each teacher will implement the teaching strategies and instructional materials during the following school year.	Objective #6 will be met through the Workshop (Participant Presentations) and Follow-Up by utilizing in-school visitations and follow-up consultation when needed.

EVALUATION PROCEDURE	
Process: A survey of teacher satisfaction will be conducted to measure adequacy of the follow-up visits.	
Outcome: Outcome evaluation for this objective will include the following:	
A. Pre- and post measures based on teacher's objectives will evaluate cognitive growth in any, or all, of the three content areas that will be taught to middle school students. If possible, comparison group(s) will be used.	B. Actual, or videotape, presentations will be evaluated by at least two project staff members. This will be accomplished through the use of an observational checklist based on the teacher's syllabus and the goals of the project.
C. Use of a table of specifications of student outcomes and an achievement test will be developed and evaluated for content validity.	D. The test referred to in "C" above will be administered to students as a measure of achievement.
E. Student satisfaction measures will be obtained.	

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APPENDIX A (cont.)

Evaluation Plan

Objective #7

OBJECTIVE	ACTIVITY
Each teacher will serve as mentor for a fellow mathematics teacher during the academic year.	Objective #7 will be met through the Teachers Helping Teachers Network.
EVALUATION PROCEDURE	
Process: Both mentor and mentee will be requested to complete an evaluation of this component which will include items related to problems encountered, successes, failures, recommendations for enhancement, and other professional satisfaction.	
Outcome: Outcome measures will be determined based on whether mentee incorporates the philosophies and techniques experienced by the project in his/her classroom and the extent to which mentee becomes a mentor for another middle school mathematics teacher.	

APPENDIX A (cont.)

Evaluation Plan

Objective #8

OBJECTIVE	ACTIVITY
Each teacher will demonstrate a sensitivity to student learning styles, particularly as they relate to minorities and other under-represented groups.	Objective #8 will be met through the Seminars and Follow-Up as specified below: A. incorporating in units strategies responsive to divergent learning styles B. incorporating in units examples of how mathematics is used by individuals in other cultures C. incorporating in units role models appropriate to minority and other underrepresented groups.

EVALUATION PROCEDURE	
Process: This section of the evaluation will include the following:	
A. A detailed syllabus including instructional objectives outlining content and procedures pertinent to the relationship of mathematical instruction to cultural diversity.	B. An evaluation instrument will be developed based on the syllabus. This instrument will be designed to measure the adequacy of content coverage and the presentation's incorporation of these strategies.
C. A survey of teacher satisfaction will be used to evaluate the seminar presentations, materials, and other aspects.	
Outcome: Outcome evaluation for this objective will be as follows: A. Teacher growth will be documented by an assessment over content matter from seminar. B. Assessment of teacher's instructional unit for sensitivity to cultural diversity will be accomplished through an observational checklist.	

APPENDIX B

Demographic Survey I
National Science Foundation Workshop

1. Age:
   - A. 21-30 Years
   - B. 31-40 Years
   - C. 41-50 Years
   - D. 51-60 Years
   - E. Above 60 Years

2. Gender:
   - A. Male
   - B. Female

3. Current Marital Status:
   - A. Married
   - B. Single
   - C. Separated
   - D. Divorced
   - E. Other: Explain: _____

4. Highest Degree Held:
   - A. B.S.
   - B. B.A.
   - C. Masters
   - D. Specialist
   - E. Doctoral

5. Year bachelor's degree awarded:
   - A. 1950 - 1960
   - B. 1961 - 1970
   - C. 1971 - 1980
   - D. 1981 - 1990
   - E. 1991 - present

6. From what institution did you receive your undergraduate degree? Please write it in.

_____.

7. What is the major field of study of your highest degree? Please write it in.

_____

8. What is your Bachelor's Degree major? Please write it in.

_____

9. What is your Bachelor's Degree minor? Please write it in.

_____

10. What is your level of certification? Please write it in.

_____

11. What is (are) your area(s) of certification? Please write in.

_____

12. Are your currently working toward an additional degree?
A. Yes.
B. No.

If so, what degree? Please write it in.

_____

What institution?

_____

13. How many years have you been teaching? Please write it in.

_____

14. How many years have you been teaching mathematics? Please write it in.

_____

15. By what school district are you employed? Please write it in.

_____

In what county? Please write it in.

_____

16. Do you hold a second job?

A. Yes.
B. No.

If so, how many hours per week are you devoted to it?

_____ Hours Per Week.

17. Highest degree obtained in school by your mother?

A. Below high school.
B. High school.
C. Bachelors
D. Masters
E. Doctoral.

18. Highest degree obtained in school by your father?

A. Below high school.
B. High school
C. Bachelors
D.Masters
E.Doctoral.

19. Were you raised in a home with both parents?

A. Yes.
B. No.

If not, with whom did you live growing up?

_____

20. Please list all math courses you took in high school?

_____

_____

_____

Briefly discuss what made you decide to major in mathematics education. Please include how you interest in math evolved starting as a young student.

Demographics Survey II
National Science Foundation Workshop

1. What grade level do you currently teach?

_____

2. In what enrichment programs, if any, have you participated ?
Please list them.

_____

3. List all professional organizations in which you hold membership (f.e., AEA, CAMA, etc.)

_____

4. Do you integrate computer usage into your classroom teaching?
   A. Yes.
   B. No.

   If so, how

_____

5. Describe briefly your teaching style.

_____

_____

_____

6. Describe briefly the administrative support for your school's math program?

_____

_____

_____

7. Do you consider being a classroom teacher your career?

A. Yes.
B. No.

8. What is the average number of hours of homework you require each night?

_____ hours each night.

Each week?

_____ hours each week.

9. Do you have student objectives for your classes?
A. Yes.
B. No.

Are they written?
A. Yes.
B. No.

Are they given to students?
A. Yes.
B. No.

Are they written in behavioral terms?
A. Yes.
B. No.

Are your evaluation procedures built from objectives?
A. Yes.
B. No.

10. Which best describes your skills in the following:

Mathematics theory?
A. Excellent.
B. Very Good.
C. Average.
D. Below Average.
E. Poor.

Mathematics teaching techniques?
A. Excellent.
B. Very Good.
C. Average.
D. Below Average.
E. Poor.

Student assessment?
A. Excellent.
B. Very Good.
C. Average.
D. Below Average.
E. Poor.

Mathematics career guidance?
A. Excellent.
B. Very Good.
C. Average.
D. Below Average.
E. Poor.

Handling student learning problems?
A. Excellent.
B. Very Good.
C. Average.
D. Below Average.
E. Poor.

Individualization of mathematics instruction?
A. Excellent.
B. Very Good.
C. Average.
D. Below Average.
E. Poor.

Answer each of the following questions in the space provided. Take as much time as you need, and make your answer as detailed as you think the problem requires. In some cases there is no single correct answer to a problem.

1. A "fair coin," when flipped, lands heads up versus tails up about equally often. You are given three fair coins and flip them simultaneously. To each of the following events, assign a probability expressed as a fraction (for example, $\frac{1}{8}$)
   (a) All three coins land heads up.
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   (d) No coin lands heads up.

2. The following seven numbers are the scores on a test given to seven students: 65, 70, 70, 85, 90, 95, 95.
   (a) What is the range of scores?
   (b) What is the average score?
   (c) What is the mean of the scores?
   (d) What is the median score?

3. A chess tournament is to be held with four players: Amy, Bev, Cal, and Dan. The object is to determine who is the best player. In chess, two people play, one against the other; you may assume ties do not happen.
   (a) Describe how to set up the tournament; who plays who, and in what order?
   (b) What is the total number of games in your tournament?

4. I have 45 cents in my pocket; I have no coins except nickels, dimes, and/or quarters; I have no more than five coins.
   (a) What specific coins could I have in my pocket that total 45 cents?
   (b) How many different right answers are there?

5. A group of 8 people are going camping for 3 days and need to carry all their water. They read in a guide book that 12.5 liters of water are required for a party of 5 persons for 1 day. How much water should they carry?

6. In order to send secret messages you decide to encode them by replacing each letter in the alphabet by the one three letters ahead of it. So, for example, A is replaced by D, B is replaced by E, and so forth. Another example: the word "BAD" after replacement of letters (encoding) becomes "EDG."

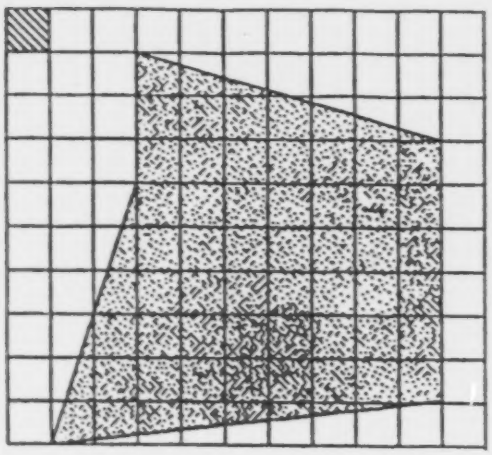
   (a) By what letters should X, Y, and Z be replaced in order to be able to encode each letter uniquely?

   (b) Encode the message "ALL STUDENTS ARE BRIGHT."

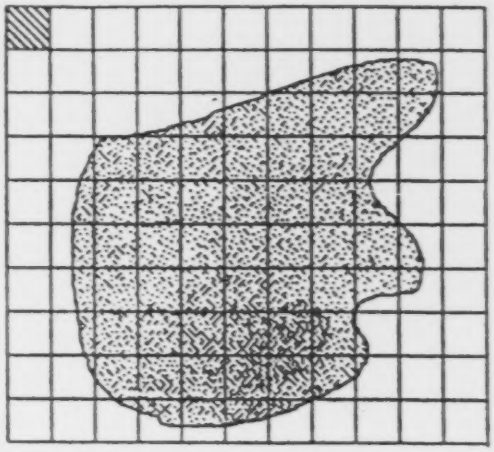
   (c) You receive the encoded secret message "BRX ZLQ DJDLQ." What was the original clear (unencoded) message?

7. In the figures below, the cross-hatched square represents 1 square centimeter of area measure. Estimate the area, in square centimeters, of each figure.

(a)



(b)



8. The following graph shows the amount of rainfall each month (on average) in two Canadian cities. Answer the questions below about the graph.
   (a) In May, which city is rainier?
   (b) If you do not like rain, in what month(s) should you avoid Vancouver?
   (c) If you do not like rain, in what month(s) should you avoid Montreal?
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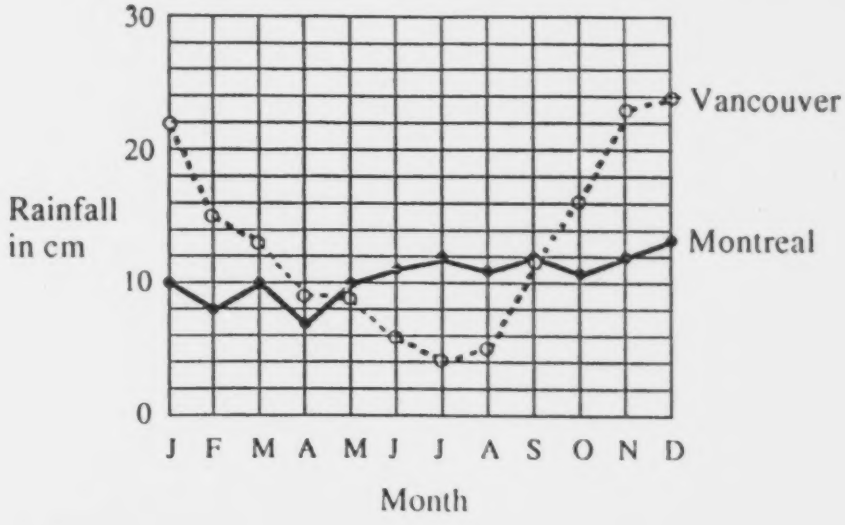
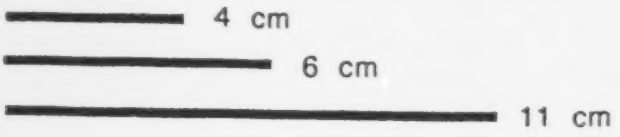


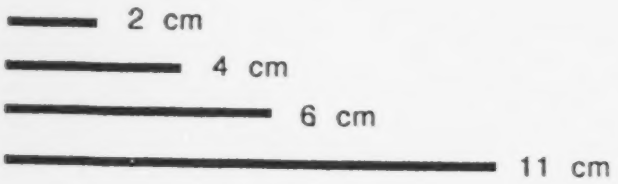
BEST COPY AVAILABLE

9. You are given sticks of the lengths and number illustrated below. In each case, determine whether or not it is possible to form the stated figure with the given sticks by having the sticks touch only at their ends.

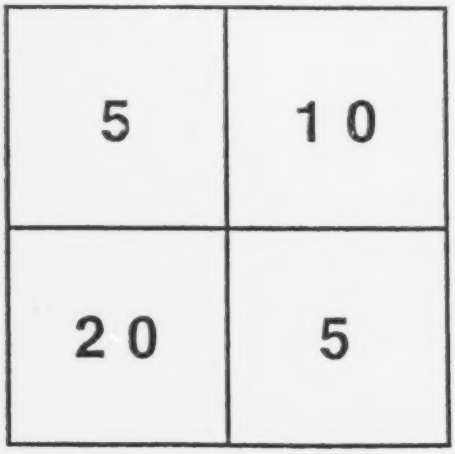
(a) Can 3 sticks of the following lengths be arranged into a triangle?



(b) Can 4 sticks of the following lengths be arranged to form a quadrilateral?



10. A special dart board is constructed as illustrated below. Assume you have no special talent at throwing darts, but that all your darts hit the board.

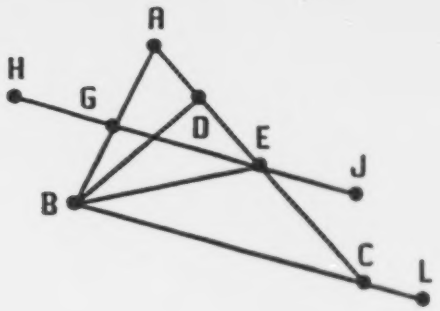


(a) Game 1: you throw 1 dart. What is the probability, expressed as a fraction, that you score at least 10 points?

(b) Game 2: you throw 2 darts. What is the probability, expressed as a fraction, that you score at least 20 points?

(c) Game 3: you throw 3 darts. What is the probability, expressed as a fraction, that you score at least 30 points?

GEOMETRY PRETEST FOR NSF INSTITUTE JUNE



Triangle Questions

Given the following information, respond to the questions below.
Angle measures in degrees- ABC=79, BAC=66, BCA=35, BDE=90.
Segment AE is congruent to segment EC. BC=4 cm. AB, BC, AC are not equal in length. Segment HJ is parallel to segment BL.

1. Which of the following are correct descriptors of triangle ABC?

   [scalene, isosceles, equilateral, equiangular, acute, right, obtuse]

2. From the segments shown, which one(s) are altitudes of the triangle?
3. Give the name of a segment that is a median of the triangle. ← (ABC)
4. What is the measure of the following angles?

   a. AGE b. GEA c. ECL

5. Name a pair of vertical angles.
6. Name a pair of adjacent angles.
7. Name a pair of supplementary angles.
8. What is the length of GE?
9. Name a pair of similar triangles.
10. Does the area of triangle ABE equal the area of triangle EBC? Why or why not?

11. Below is an illustration of an aquarium along with a graph of its water level as a function of time. When the faucet is on, water flows into the aquarium at a steady rate. When the plug is pulled out, water flows out of the aquarium at a steady rate, but slower than the faucet's rate. At various times some events happen which affect the water level and/or the rate at which it changes. Identify the time at which each of the following events occurs:

____1. The plug is pulled out with the faucet turned off.

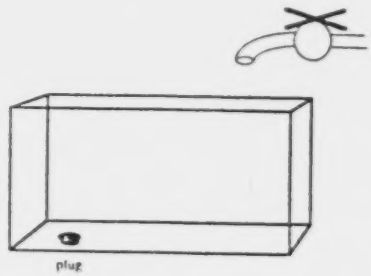
____2. The plug is pulled out with the faucet turned on.

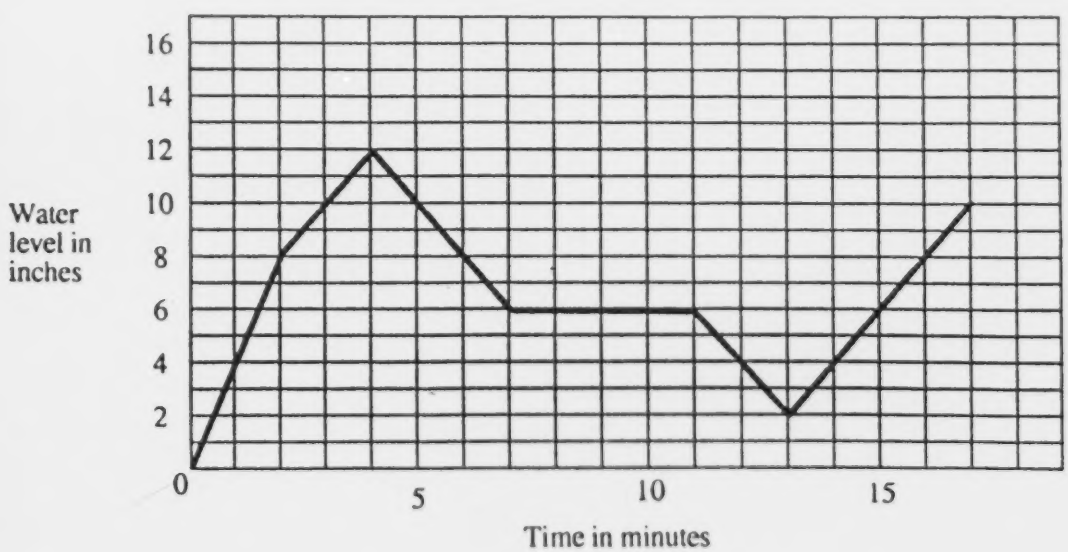
____3. The plug is put in with the faucet turned off.

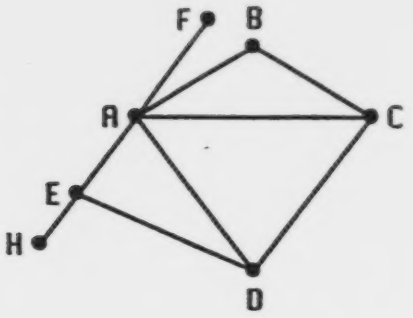
____4. The faucet is turned off with the plug out.

____5. The faucet is turned on with the plug in.

____6. The faucet is turned on with the plug out.







Polygon Questions

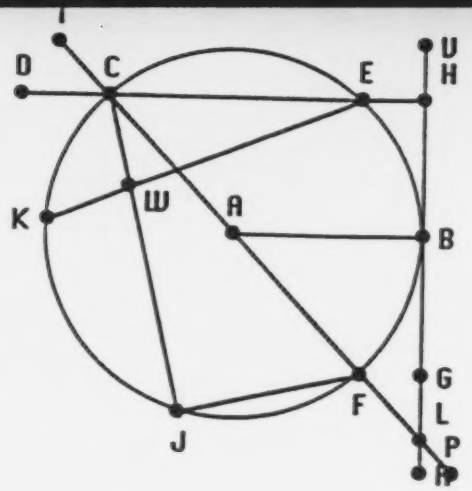
Given AB=BC, AD=DC, AB does not equal AD, and segment HF is parallel to segment DC.

1. If possible, give examples of the following polygons that are shown in the diagram. Use letter names such as ABCD... to name the figures. (Name as many as you can see in the diagram. If none exists, write **None**.)
   a. Quadrilaterals
   b. Trapezoids
   c. Parallelograms
   d. Kites
   e. Pentagons
   f. Hexagons

2. What is the sum of the measures of the interior angles of polygon ABCDE? Explain how you arrived at this answer.

3. Which of the following pairs of angles are congruent?
   a. ABC, ADC b. DAC, DCA c. HED, EDC d. ADC, ACD

4. In the diagram, if point E were to be moved toward point H so that EA=DC, tell as much as you can about polygon AEDC.



Circle Questions

Use the following information to respond to the questions that follow. Point A is the center of the circle. Segment DH is parallel to segment AB. AB=10, JF=10, m<BAF=48 degrees, measure of arc JF= 60 degrees.

1. What is the circumference of the circle?

2. What is the area of the circle?

3. Choose either arc, chord, secant, tangent, diameter, or radius as the best descriptor of each of the following segments:

a. KE b. HG c. DH d. AC

4. Find the length of segment CJ.

5. Draw in segment AE. What is its length? Is triangle CAE a right triangle? Justify your answer.

6. Draw segment AJ. Find the area of triangle AJF.

Years 2 : 3 Pretest

MA 501 PRE-TEST

Answer each of the following questions. Make your answer as detailed as you think the problem requires. In some cases there is no single correct answer to a problem.

1. A "fair coin," when flipped, lands heads up versus tails up about equally often. You are given three fair coins and flip them simultaneously. To each of the following events, assign a probability expressed as a fraction (for example, $\frac{1}{8}$).
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   (a) What is the range of scores?
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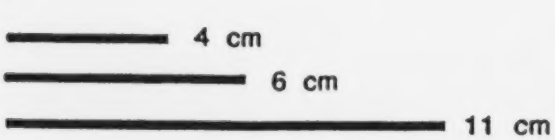
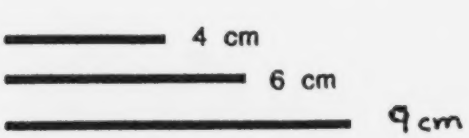
   (a) By what letters should XYZ be replaced in order to be able to encode each letter uniquely?
   (b) Encode the message "ALL STUDENTS ARE BRIGHT."
   (c) Decode the message "BRX ZLQ DJDLQ."

6. You are given 3 sticks of the lengths illustrated below. In each case, determine whether or not it is possible to form a triangle with the given sticks by having the sticks touch only at their ends.

(a)



(b)



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(a) In May, which city is rainier?

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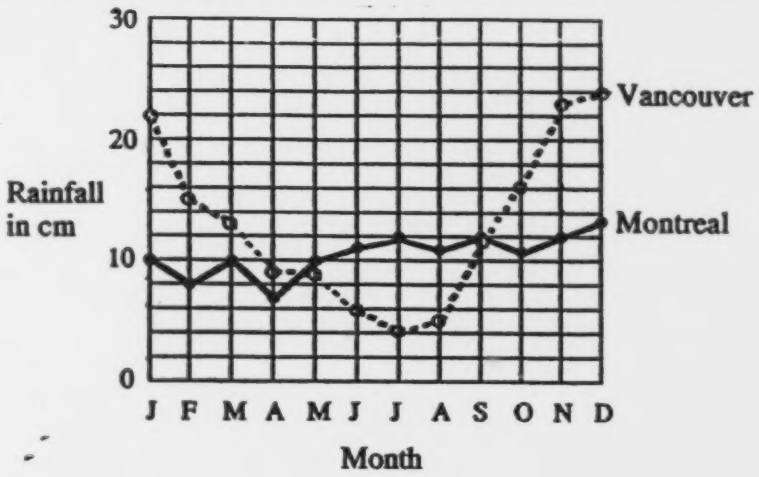
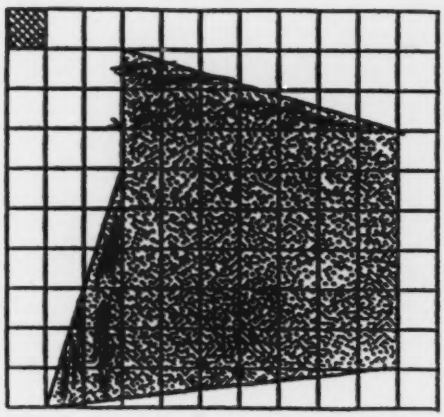


8. In the figures below, the cross-hatched square represents 1 square centimeter of area measure. As accurately as you can, estimate the area in square centimeters of each shaded figure.

(a)



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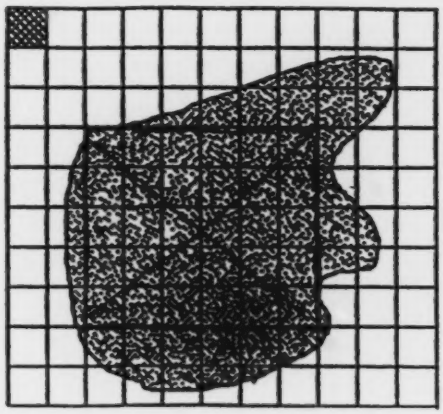

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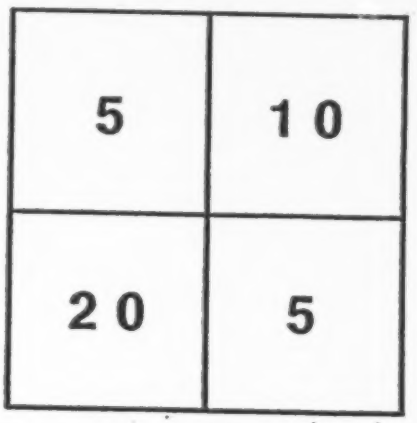

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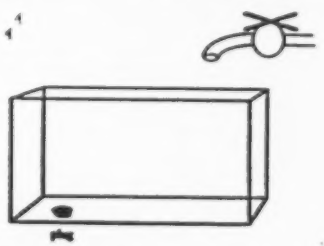
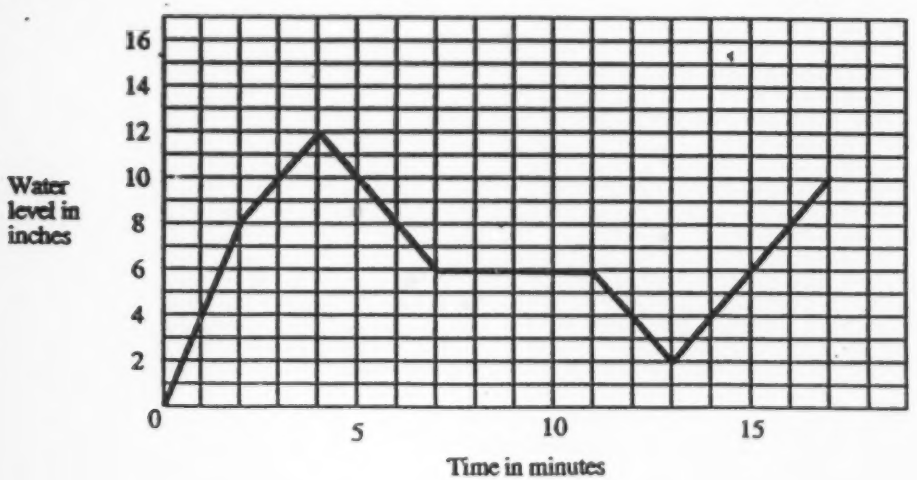
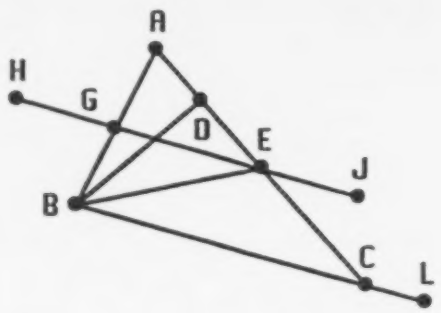




GEOMETRY PRETEST FOR NSF INSTITUTE JUNE



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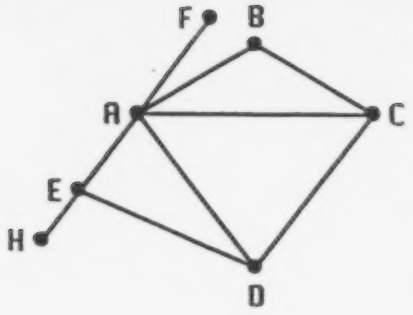

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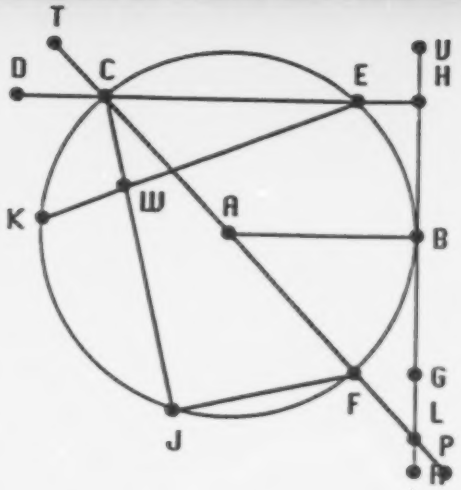

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4. Find the length of segment CJ.

5. Draw in segment AE. What is its length? Is triangle CAE a right triangle? Justify your answer.

6. Draw segment AJ. Find the area of triangle AJF.

TO BE COMPLETED BY NSF PARTICIPANT

Social Security #_____

Efficacy of Technologies Scale

Directions: First, Please place your social security number in the top right-hand space as indicated. Second, please indicate the degree to which you agree or disagree with each statement below by circling the appropriate response.

SA=Strongly Agree
A=Agree
UN=Uncertain
D=Disagree
SD=Strongly Disagree

A. Computer Usage:

1. As a result of having participated in this NSF project, I have learned additional uses of the computer for my class.	SA	A	U	D	SD
2. I am more proficient at using the computer as an instructional resource as a result of having participated in this NSF project.	SA	A	U	D	SD
3. I am more confident in using computers in my classroom as a result of having participating in this NSF workshop.	SA	A	U	D	SD
4. After having participated in this NSF project, I understand computer capabilities well enough to be effective in using them in my classroom.	SA	A	U	D	SD
5. As a result of participating in this project, I now use computers in my class more frequently than before attending this project.	SA	A	U	D	SD
6. When a student shows improvement in using the computer, it is often because I exerted a little extra effort.	SA	A	U	D	SD
7. When my students' attitudes toward using computers improve, it is often due to my having used the classroom computer(s) in more effective ways.	SA	A	U	D	SD
8. The teacher is generally responsible for students' compentence in computer usage.	SA	A	U	D	SD
9. My students' computer ability is directly related to my effectiveness in classroom computer use.	SA	A	U	D	SD
10. My students' computer ability is directly related to my effectiveness in classroom computer use.	SA	A	U	D	SD
11. If parents comment that their child is showing more interest in computers, it is probably due to my performance.	SA	A	U	D	SD
12. Even when I try very hard, I do not use the computer as well as I do other instructional resources.	SA	A	U	D	SD
13. I am not very effective in monitoring students' computer use in my class.	SA	A	U	D	SD
14. I don't find it as difficult to explain to students how to use the computer, since participating in this workshop.	SA	A	U	D	SD
15. I am typically able to answer students' questions which relate to the computer.	SA	A	U	D	SD
16. Given a choice, I would <u>not</u> invite the principal to evaluate my computer-based instruction.	SA	A	U	D	SD
17. When students have difficulty with the computer, I am usually at a loss as to how to help them.	SA	A	U	D	SD
18. When using the computer, I usually welcome student questions.	SA	A	U	D	SD
19. I do not know what to do to turn students on to computers.	SA	A	U	D	SD
20. Whenever I can, I avoid using computers in the classroom.	SA	A	U	D	SD

B. Manipulatives:

1. As a result of participating in this NSF project, I use manipulatives in my class when they fit the lesson I am teaching.	SA	A	U	D	SD
2. As a result of participating in this project, I use manipulatives more effectively in my math class.	SA	A	U	D	SD
3. I feel comfortable using manipulatives in my math teaching as a result of having participated in this NSF project.	SA	A	U	D	SD
4. I have gained necessary teaching skills to use manipulatives in my class through participating in this NSF project.	SA	A	U	D	SD
5. Which of the following are possible barriers to your greater use of manipulatives in your classroom:					
a. they cost too much money.	SA	A	U	D	SD
b. they take too much time.	SA	A	U	D	SD
c. the students will be too noisy.	SA	A	U	D	SD
d. they take up too much space.	SA	A	U	D	SD
e. I don't have any.	SA	A	U	D	SD
f. my principal doesn't like them.	SA	A	U	D	SD
g. I have to cover the book.	SA	A	U	D	SD
h. clean-up takes too long.	SA	A	U	D	SD
i. the kids don't learn anything with them.	SA	A	U	D	SD
j. parents don't like them.	SA	A	U	D	SD
k. they will get lost, broken, or stolen.	SA	A	U	D	SD
l. the kids are hyper when I have tried to use them in the past.	SA	A	U	D	SD
m. I don't know how to use them.	SA	A	U	D	SD
n. they are not geared to a particular grade level.	SA	A	U	D	SD
o. children only play with them.	SA	A	U	D	SD
p. organizing them is a hassle.	SA	A	U	D	SD
q. storing them is a hassle.	SA	A	U	D	SD
r. children have to learn to use paper and pencil.	SA	A	U	D	SD
s. it takes too much planning time.	SA	A	U	D	SD
t. I like the way I teach, and I don't want to change.	SA	A	U	D	SD
u. Other: Please use this space as needed.					

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IMPLEMENTATION MATRIX FOR NCTM STANDARDS

Title of Unit: _____

Author of Unit: _____

Objective of Unit: _____

Age/Grade for Which Appropriate: _____

Synopsis of Unit: _____

_____

_____

_____

_____

_____

_____

Checked by _____

To what degree does this unit meet the following standards:

Items	Excellent	Above Average	Average	Below Average	Poor
1. Capacity to help students integrate mathematics into other curriculum areas?					
2. Capacity to motivate students to share thoughts with teacher and other students?					
3. Capacity to help students find mathematics personally meaningful?					
4. Capacity to empower students in mathematics?					
5. Capacity to assist students in making connection of mathematics to other areas of his/her life?					
6. Capacity to assist students in using a variety of thinking processes and strategies?					
7. Capacity to have active participation of students?					
8. Capacity to increase positive student attitudes toward mathematics?					
9. Capacity to facilitate students' use of investigatory/reasoning skills?					
10.Capacity to communicate sensitivity to cultural diversity?					
11. Capacity to increase technology skills of students?					

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Checked by _____

TO BE COMPLETED BY NSF PARTICIPANT

NSF Student-Developed Project Data Form:

Name:

Title of Project (Unit) You Developed During this NSF Project:

Please answer the following questions relative to the project you developed during the NSF workshop.

1. Did your project include the use of technology? Yes No
If it included technology, please specify what type.

2. Have you used the project you developed with the class (es) you teach? If no, please specify why?

3. When have you used this project? (Please give approximate dates).

4. After using your project, did you have to modify it in any way; in other words, was it suitable as developed or did you have to make changes to it? If so, why and what type changes?

5. What other units that were introduced to you in this NSF project have you used in your classroom? Please be specific.

8. What other resources are you using in your lesson plans? Please give examples.

9. Have you and your mentee communicated and shared feedback relative to your project and any modifications you found necessary?

Social Security #: _____

TO BE COMPLETED BY NSF PARTICIPANT

Teacher Perceptions of Student Achievement

1. Since implementing units, teaching strategies, etc. that you gained from the NSF project, do you believe your students are developing a better understanding of the mathematics content you teach them?

Yes No

Please explain your answer. For example, why do you believe this to be the case. What evidence do you have of their increased understanding?

2. Have you noticed that your students are performing better on measures of classroom achievement in your mathematics class(es) since your participation in this NSF project?

Yes No

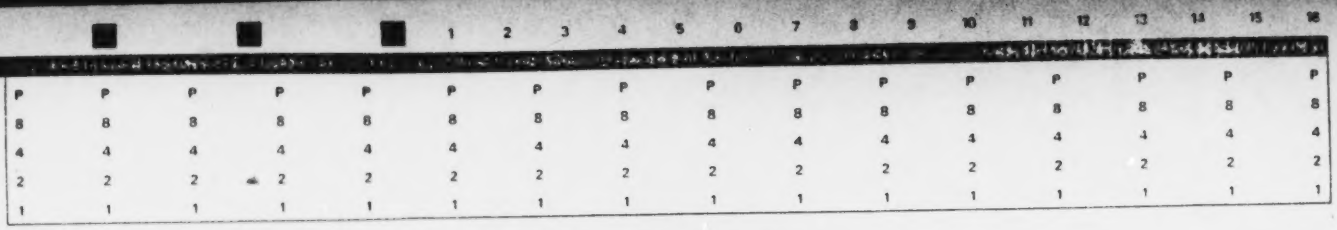
Please explain your answer.

3. What additional measures have you used to measure student mastery of information other than test scores as a result of participating in this NSF project?

4. Have standardized test scores of your students improved since your participation in this project?

Yes No

If so, can you attribute this improvement to any changes in teacher behavior which took place as a result of your participation in this NSF project?



Mathematics Survey:

Directions: Please color in the circle of the number that best describes your reaction to each of these items below.

Strongly Disagree 5
Disagree 4
No Opinion 3
Agree 2
Strongly Agree 1

A. I like this math class?	1	2	3	4	5
B. This math teacher helps me to like math better than other math teachers I have had.	1	2	3	4	5
C. This math teacher shows me how to use math in everyday life more than other math teachers.	1	2	3	4	5
D. This math teacher wants me to learn how to solve problems, not just get right answers.	1	2	3	4	5
E. This math teacher lets us actively participate in class.	1	2	3	4	5
F. This math teacher gives us work so that I can learn from other students in my class.	1	2	3	4	5
G. This math teacher lets us work on the computer.	1	2	3	4	5
1. My teacher encourages me to study mathematics more.	1	2	3	4	5
2. My teacher thinks I am the kind of person who can do well in math.	1	2	3	4	5
3. My teacher makes me feel I have the ability to go further in math.	1	2	3	4	5
4. My teacher encourages me to take all the math I can.	1	2	3	4	5
5. My teacher is interested in my progress in math.	1	2	3	4	5
6. I talk to my teacher about a career which uses math.	1	2	3	4	5
7. When it comes to anything serious, I feel ignored when talking to my math teacher.	1	2	3	4	5
8. I find it hard to win the respect of my math teacher.	1	2	3	4	5
9. My teacher thinks advanced math is a waste of time for me.	1	2	3	4	5
10. Getting my math teacher to take me seriously is a problem.	1	2	3	4	5
11. My teacher wouldn't think I was serious if I told her I was interested in a math career.	1	2	3	4	5
12. I have a hard time getting my teacher to talk seriously with me about math.	1	2	3	4	5
13. Generally, I feel secure about trying math.	1	2	3	4	5
14. I am sure I can do advanced work in math.	1	2	3	4	5
15. I am sure that I can learn math.	1	2	3	4	5
16. I think I can handle more difficult mathematics.	1	2	3	4	5
17. I can get good grades in math.	1	2	3	4	5
18. I have self-confidence when it comes to math.	1	2	3	4	5
19. I'm not good at math.	1	2	3	4	5
20. I don't think I could do advanced mathematics.	1	2	3	4	5
21. I'm not the type to do well in math.	1	2	3	4	5
22. For some reason even though I study, math seems hard for me.	1	2	3	4	5
23. Most subjects I can handle all right, but I have a knack for messing up math.	1	2	3	4	5
24. Math is my worst subject.	1	2	3	4	5

Please DO NOT turn your paper over until you are asked to do so.

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Strongly Disagree 5 ____
Disagree 4 ____
No Opinion 3 ____
Agree 2 ____
Strongly Agree 1 ____

	▼	▼	▼	▼	▼
25. I'll need math for my future work. ---------->	1	2	3	4	5
26. I study math because I know how useful it is. ---------->	1	2	3	4	5
27. Knowing mathematics will help me earn a living. ---------->	1	2	3	4	5
28. Mathematics is a worthwhile and necessary subject. ---------->	1	2	3	4	5
29. I'll need a firm mastery of mathematics for my future work. ---------->	1	2	3	4	5
30. I will use math in many ways as an adult. ---------->	1	2	3	4	5
31. Mathematics is not important to me. ---------->	1	2	3	4	5
32. Mathematics will not be important to me in my life's work. ---------->	1	2	3	4	5
33. I see math as a subject I will rarely use in my daily life as an adult. ---------->	1	2	3	4	5
34. Taking math is a waste of time. ---------->	1	2	3	4	5
35. In terms of my adult life, it is not important for me to do well in math in high school. ---------->	1	2	3	4	5
36. I expect to have little use for math when I get out of school. ---------->	1	2	3	4	5
37. It would make me happy to be recognized as an excellent student in math. ---------->	1	2	3	4	5
38. I'd be proud to be the outstanding student in math. ---------->	1	2	3	4	5
39. I'd be happy to get top grades in math. ---------->	1	2	3	4	5
40. It would be really great to win a prize in mathematics. ---------->	1	2	3	4	5
41. Being first in mathematics competition would make me pleased. ---------->	1	2	3	4	5
42. Being thought of as smart in math would be a great thing. ---------->	1	2	3	4	5
43. Winning a prize in mathematics would made me stand out in the crowd. ---------->	1	2	3	4	5
44. People would think I was some kind of a nerd if I got A's in math. ---------->	1	2	3	4	5
45. If I had good grades in math, I would try to hide it. ---------->	1	2	3	4	5
46. If I got the highest grade in math, I'd prefer no one knew it. ---------->	1	2	3	4	5
47. It would make people like me less if I were a really good math student. ---------->	1	2	3	4	5
48. I don't like for people to think that I am smart in math. ---------->	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5

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Name:_____

The Teaching Style Inventory

developed by
Rita Dunn and Kenneth Dunn

An Instrument To Identify the Way in Which
a Teacher Actually Functions as to
Form Groupings on the Basis of
Complementary Student and Teacher Styles

Code:

Never:	0 time per **year**
Rarely:	up to 6 times per **year**
Occasionally	2 to 4 times per **month**
Frequently	2 to 3 time per **week**
Always:	4 to 5 time per **week** or more

Evaluation Systems, Inc.

Question 1: *Instructional Planning*

Directions:
Circle the number that best describes how often you use each of the following planning techniques.

	Never	Rarely	Occasionally	Frequently	Always
a) Diagnosis and prescription for each student	1	2	3	4	5
b) Whole class lessons	5	4	3	2	1
c) Contracts, learning activity packages, or instructional packages	1	2	3	4	5
d) Creative activities with student options	1	2	3	4	5
e) Programmed materials or drill assignments	1	2	3	4	5
f) Small-group assignments	1	2	3	4	5
g) Task cards or games	1	2	3	4	5
h) Objectives	1	2	3	4	5
i) Peer tutoring or team learning	1	2	3	4	5
j) Role playing or simulations	1	2	3	4	5
k) Brainstorming or circles of knowledge	1	2	3	4	5
l) Students design their own studies	1	2	3	4	5

Question 2: *Teaching Methods*

Directions:
Circle the number that best describes how often you use each of the following teaching methods.

	Never	Rarely	Occasionally	Frequently	Always
a) Lecture (whole class)	5	4	3	2	1
b) Teacher demonstration	5	4	3	2	1
c) Small groups (3-8)	1	2	3	4	5
d) Media (films, tapes, etc.)	1	2	3	4	5
e) Class discussion (question-answer)	5	4	3	2	1
f) Individualized (diagnosis and prescription for each student)	1	2	3	4	5

Question 3: *Teaching Environment*

3.1: *Student Groupings*

Directions:
Circle the number that best describes how often you use each of the following types of groupings.

	Never	Rarely	Occasionally	Frequently	Always
a) Several small groups (3-8 students)	1	2	3	4	5
b) Pairs (2 students)	1	2	3	4	5
c) Independent study assignments (student works alone)	1	2	3	4	5
d) One-to-one interactions with teacher	1	2	3	4	5
e) Two or more of the above groupings at one time	1	2	3	4	5
f) One large group (entire class)	5	4	3	2	1

Question 3.2: *Room Design*

Directions:
Circle the number that best describes how often you use each of the following classroom designs.

	Never	Rarely	Occasionally	Frequently	Always
a) Rows of desks	5	4	3	2	1
b) Small groups of 3-8 students	1	2	3	4	5
c) Learning stations or interest centers	1	2	3	4	5
d) A variety of areas	1	2	3	4	5
e) Individual and small-group (2-4) alcoves, dens, "offices"	1	2	3	4	5
f) Three or more of the above arrangements at the same time	1	2	3	4	5

Question 3.3: *Teaching Environment*

Directions:
Circle the number that best describes your present instructional environment.

	Never	Rarely	Occasionally	Frequently	Always
a) Varied instructional areas are provided in the classroom for different, simultaneous activities	1	2	3	4	5
b) Nutritional intake is available for all students as needed	1	2	3	4	5
c) Instructional areas are designed for different groups that need to talk and interact	1	2	3	4	5
d) Varied time schedules are in use for individuals	1	2	3	4	5
e) Students are permitted to choose where they will sit and/or work	1	2	3	4	5
f) Many multisensory resources are available in the classroom for use by individuals and groups	1	2	3	4	5
g) Alternative arrangements are made for mobile, active, or overly talkative students	1	2	3	4	5

Question 4: *Evaluation Techniques*

Directions:
Circle the number that best describes how often you use each of the following evaluation techniques. I use:

	Never	Rarely	Occasionally	Frequently	Always
a) Observation by moving from group to group and among individuals	1	2	3	4	5
b) Teacher-made tests	1	2	3	4	5
c) Student self-assessment tests	1	2	3	4	5
d) Performance tests (demonstrations rather than written responses)	1	2	3	4	5
e) Criterion-referenced achievement tests* based on student self-selected, individual objectives	1	2	3	4	5
f) Criterion-referenced achievement tests* based on small-group objectives	1	2	3	4	5
g) Standardized achievement tests based on grade-level objectives	1	2	3	4	5
h) Criterion-referenced achievement tests* based on the individual student's potential	1	2	3	4	5

Question 5: *Teaching Characteristics and Classroom Management***

Directions:
Circle the number that best describes you as a teacher. I tend to be:

	Not At All	Not Very	Somewhat	Very	Extremely
a) Concerned with how students learn (learning style)	1	2	3	4	5
b) Prescriptive (with student options)	1	2	3	4	5
c) Demanding—with high expectations based on individual ability	1	2	3	4	5
d) Evaluative of students as they work	1	2	3	4	5
e) Concerned with how much students learn (grade level standards)	5	4	3	2	1
f) Concerned with what students learn (grade level curriculum)	5	4	3	2	1
g) Lesson plan oriented	5	4	3	2	1
h) Authoritative to reach group objectives	5	4	3	2	1

Question 6: *Educational Philosophy*

Directions:
Circle the number that best describes your attitude toward each of the following approaches and concepts.

	Strongly Disagree	Disagree	Undecided	Support	Strongly Support
a) Open education	1	2	3	4	5
b) Diagnostic-prescriptive teaching	1	2	3	4	5
c) Multiage groupings	1	2	3	4	5
d) Matched teaching and learning styles	1	2	3	4	5
e) Alternative education	1	2	3	4	5
f) Student-centered curriculum	1	2	3	4	5
g) Behavioral or performance objectives	1	2	3	4	5
h) Humanistic education	1	2	3	4	5
i) Independent study	1	2	3	4	5
j) Individualized instruction	1	2	3	4	5
k) Traditional education	5	4	3	2	1
l) Whole-group achievement	5	4	3	2	1
m) Grade-level standards	5	4	3	2	1
n) Teacher-dominated instruction	5	4	3	2	1

*Criterion-Referenced Achievement Tests: The questions on these tests are based directly on the objectives assigned to or selected by the students.

**When teachers respond that they are "concerned with how students learn," the inference is that they permit options in the learning environment because of their awareness of individual differences. An observer should be able to see students working alone, with a peer or two, or with the teacher; sitting on chairs or on carpeting; using self-selected resources of a multisensory nature (if available); mobile (if necessary and without disturbing others), etc.

Social Security #_____

Exit Interview -- National Science Foundation Project

Directions: First, please place your social security number in the top right-hand space as indicated. Second, indicate the degree to which you agree or disagree with each statement below by circling the appropriate response.

SA= Strongly Agree
A= Agree
UN= Uncertain
D= Disagree
SD= Strongly Disagree

1. This project has helped me to develop new ways of assisting students to integrate mathematics into other areas of their curriculum.	SA	A	U	D	SD
2. This project has helped me to develop new techniques to motivate my students to share their thought processes with me and the other students in class.	SA	A	U	D	SD
3. This project has helped me to develop additional ways to make mathematics more meaningful to my students.	SA	A	U	D	SD
4. By going through this NSF project at UAB, I have gained new ideas and techniques that I can use to assist students in feeling more in control of their success in mathematics.	SA	A	U	D	SD
5. By participating in this project, I find myself encouraging and reinforcing students to justify their solutions and thinking processes in a variety of ways as opposed to only a single way.	SA	A	U	D	SD
6. Through this project, I have learned new ideas about how to give students opportunities to connect what they learn in my class to other areas of their lives.	SA	A	U	D	SD
7. As a result of participating in this project, I have gained new techniques for assisting my students in being more active learners.	SA	A	U	D	SD
8. By going through this project, I now give my students more opportunities to investigate, find their own solutions, and justify their answer.	SA	A	U	D	SD
9. Through this project, I have gained new techniques and ideas regarding increasing positive student attitudes toward math.	SA	A	U	D	SD
10. As a result of participating in this project, I give my students more opportunities to acquire good reasoning skills.	SA	A	U	D	SD
11. By participating in this project, I find that I am more sensitive to cultural/socioeconomic differences of my students.	SA	A	U	D	SD
12. I have gained more confidence and skill at using computers, manipulatives, and other technology aids as a result of participating in this project.	SA	A	U	D	SD

1. What skills have you learned through this project that help you in increasing positive student attitudes about mathematics? (Please use the back of the page if needed).

2. What skills, content, etc. have you acquired through this project that help you address cultural and/or socioeconomic differences in your students more sensitively? (Please use the back of the page if needed).

3. What professional activities have you become involved in as a result of participating in this NSF project? (for example, presentations made, associations joined, as well as any other activities that you have become involved)?

4. Reflecting over the course of your involvement in this project, how do you feel this project has assisted you in becoming a better teacher? How have you changed your teaching style as a result of having participated in this project? (Please use the back of the page if needed)

Classroom Observation Schedule

Teacher: _____

Date: ___/___/___
[Starting Time: _____ Ending Time: _____]

Observer: _____

I. Classroom Climate:	Very Good	Satisfactory	Needs Work	Not Observed
Creates comfortable climate for learning?				
Is enthusiastic about subject?				
Inspires excitement/interest in subject matter?				
Seems to enjoy teaching?				
Has sense of humor?				
Invites students to share knowledge/experiences?				
Invites criticisms of his/her ideas?				
Appears to have genuine interest in students?				
Demonstrates respect for students?				
Knows when students are bored/confused?				
Compliments students for raising good points?				

Classroom Climate Comments:

II. Classroom Management:	Very Good	Satisfactory	Needs Work	Not Observed
Has student behavior under control?				
Anticipates behavioral problems and uses preventive mechanisms to stop misbehavior?				
Response to classroom misbehavior is appropriate?				
Uses rewards appropriately?				

Classroom Management Comments:

Teacher: _____

III. Communication:

A. Nonverbal:

	Very Good	Satisfactory	Needs Work	Not Observed
Maintains eye contact with students?				
Has physical contact with students?				
Uses facial expressions to emphasize importance of material?				
Varies tone of voice?				
Posture and head movements enhance learning?				

Nonverbal Communication Comments:

B. Verbal:

	Very Good	Satisfactory	Needs Work	Not Observed
Speak clearly and audibly?				
Is courteous to students?				
Responds appropriately to student responses?				

Verbal Communication Comments:

IV. Competency/Preparation:

	Very Good	Satisfactory	Needs Work	Not Observed
Is prepared/organized?				
Is competent in subject matter?				
Is competent in integrating technology into classroom activities?				
Appears poised and self-confident?				
Knows if class is understanding what is being taught?				
Quickly grasps what a student is asking/stating?				
Clears up points of confusion for students?				
Responds appropriately to frustrating class situations?				
Is good role model?				

Teacher Preparation/Competency Comments:

Teacher: _____

V. Instructional Style:

	Very Good	Satisfactory	Needs Work	Not Observed
Instructional style matches curriculum?				
Emphasizes ways of solving problems rather than solutions?				
Communicates purpose of class sessions/instructional activities?				
Presents information at rate students can follow?				
Indicates which information is essential/minor?				
Uses examples/illustrations to clarify?				
Manages classroom discussions to benefit students?				
Connects important relationships among topics in course?				
Discusses practical applications?				
Has students apply concepts to demonstrate competency?				
Focuses student attention in preparation for learning?				
Provides all students opportunities for participation?				
Provides learning activities which foster peer interaction?				
Uses variety of questioning levels?				
Asks questions which challenge students?				
Restates questions/comments to clarify for entire class?				
Provides opportunities for students to bring up/discuss issues related to course?				
Presents activities/materials appropriate to students' level of ability and experience?				
Has definite plan but uses materials introduced by students?				
States objectives at beginning of each class?				
Provides objectives in written form for students?				
Uses blackboard effectively?				
Uses other audio visual aids? If so, what? _____				

Instructional Style Comments:

VI. Materials/Equipment:

	Very Good	Satisfactory	Needs Work	Not Observed
Materials/equipment are adequate to accomplish overall objectives of subject?				
Students are provided with materials/equipment which facilitates mastery of information?(e.g. calculators, manipulatives)				

Materials/Equipment Comments:

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Teacher: _____

VII. Physical Arrangement of Classroom:

	Very Good	Satisfactory	Needs Work	Not Observed
Physical arrangements enhance learning?				
Physical arrangements fit lesson plan?				
Room in class for teacher movement?				
Students' sensory needs met? (lighting, temperature, noise level, etc.)				

Physical Arrangement Comments:

VIII. Student/Teacher Interactions:

	Very Good	Satisfactory	Needs Work	Not Observed
Moves about the classroom?				
Teacher movements enhance learning?				
Teacher movements divided approximately equally among all students?				
Students respond appropriately to directions given by teacher?				
Students respond appropriately to corrections of work/behavior?				
Students appear to like teacher?				

Student/Teacher Interaction Comments:

Teacher: _____

IX. Technology Integration:

	Very Good	Satisfactory	Needs Work	Not Observed
Feels comfortable integrating technology into classroom activities?				
Is competent with different software packages?				
Explains effectively to students how to use computer?				
Appears to inspire students to learn about computers?				
Appears comfortable in overcoming computer difficulties in class?				
Is open to student questions regarding computer?				

Technology Integration Comments:

X. Time Management Skills:

	Very Good	Satisfactory	Needs Work	Not Observed
Uses instructional time effectively?				
Is punctual in meeting class?				
Provides time for discussion/comments/questions?				

Time Management Comments:

XI. Cultural Sensitivity	Very Good	Satisfactory	Needs Work	Not Observed
Uses culturally relevant examples?				
Classroom exhibits are culturally relevant?				
Teacher shows sensivity to cultural differences?				

Comments:

TO BE COMPLETED BY NSF PARTICIPANT

Social Security #_____

Mentor Evaluation -- National Science Foundation (NSF) Project

Directions: Please place your social security number in the top right-hand space as indicated and answer the following questions below.

1. Why did you choose the person for your mentee that you ultimately chose?

2. Was the person you chose as your mentee as good choice? Why or why not.

3. What did you like about the mentor-mentee aspect of the National Science Foundation Project in which you have been involved?

4. What would you change about the mentor-mentee aspect of the National Science Foundation Project in which you have been involved?

5. How do you think being involved in this mentor-mentee program has helped you professionally?

6. As a result of being involved in this project, what ideas, equipment, instructional aids, etc. have you shared with your mentee; in other words, have you all been supportive of each other?

TO BE COMPLETED BY MENTEE

Mentor: _____

Mentee Evaluation -- National Science Foundation (NSF) Project

Directions: Please place the name of your mentor in the space directly above. Then, please answer the following questions below.

1. What did you like about the mentor-mentee aspect of the National Science Foundation Project in which you have been involved?

2. What would you change about the mentor-mentee aspect of the National Science Foundation Project in which you have been involved?

3. How do you think being involved in this mentor-mentee program has helped you professionally?

4. List at least two skills you gained from interaction with your mentor and that you have implemented in your classroom?

Last, please indicate the degree to which you agree or disagree with each statement below by circling the appropriate response.

SA= Strongly Agree
A= Agree
UN= Uncertain
D= Disagree
SD= Strongly Disagree

Being a mentee in this NSF project has helped me to:

1. develop new ways of assisting students to integrate mathematics into other areas of their curriculum.	SA	A	U	D	SD
2. develop new techniques to motivate my students to share their thought processes with me and the other students in class.	SA	A	U	D	SD
3. develop additional ways to make mathematics more meaningful to my students.	SA	A	U	D	SD
4. gain new ideas and techniques that I can use to assist students in feeling more in control of their success in mathematics.	SA	A	U	D	SD
5. encourage and reinforce students to justify their solutions and thinking processes in a variety of ways as opposed to only a single way.	SA	A	U	D	SD
6. learn new ideas about how to give students opportunities to connect what they learn in my class to other areas of their lives.	SA	A	U	D	SD
7. gain new techniques for assisting my students in being more active learners.	SA	A	U	D	SD
8. give my students more opportunities to investigate, find their own solutions, and justify their answer.	SA	A	U	D	SD
9. learn new techniques and ideas regarding increasing positive student attitudes toward math.	SA	A	U	D	SD
10. give my students more opportunities to acquire good reasoning skills.	SA	A	U	D	SD
11. be more sensitive to cultural/socioeconomic differences of my students.	SA	A	U	D	SD
12. gain more confidence and skill at using computers, manipulatives, and other technology aids as a result of participating in this project.	SA	A	U	D	SD

Learning Styles Questionnaire

Name:_____
Date:_____

Directions: Answer "True" or "False" to each of the following questions.

I. Environmental Stimuli:

A. Sound:

	True:	False:
1. I study best when it is quiet.	____	____
2. I can work with a little noise.	____	____
3. I can block out noise when I work.	____	____
4. Noise usually keeps me from concentrating.	____	____
5. Most of the time I like to work with soft music.	____	____
6. I can work with any kind of music.	____	____
7. I often like to work with rock music playing.	____	____
8. Music makes if difficult for me to work.	____	____
9. I can work if people talk quietly.	____	____
10. I can study when people talk.	____	____
11. I can block out most sound when I study.	____	____
12. It is difficult to block out TV when I work.	____	____
13. Noise bothers me whe I am studying.	____	____

B. Lighting:

	True:	False:
1. I like studying with lots of light.	____	____
2. I study best when the lights are low.	____	____
3. I like to read outdoors.	____	____
4. I can study for a short time if lights are low.	____	____
5. When I study I put all the lights on.	____	____
6. I often read in dim light.	____	____
7. I usually study under a shaded lamp while the rest of the room is dim.	____	____

C. Temperature:

	True	False
1. I can concentrate if I am warm.	____	____
2. I can concentrate if I am cold.	____	____
3. I usually feel colder than most people.	____	____
4. I usually feel warmer than most people.	____	____
5. I like the summer.	____	____
6. When it is cold outside, I like to stay in.	____	____
7. When it is hot outside, I like to stay in.	____	____
8. When it is hot outside, I like to be outside.	____	____
9. When it is cold outside, I like to be outside.	____	____
10. I find extreme heat or cold uncomfortable.	____	____
11. I like the winter.	____	____

D. Design:

	True	False
1. When I study I like to sit on the floor.	____	____
2. When I study I like to sit on a soft chair or couch.	____	____
3. When I study I feel sleepy unless I sit on a hard chair.	____	____
4. I find it difficult to study at home.	____	____
5. I finish all my homework at school.	____	____
6. I always study for tests at home.	____	____
7. I finish all my homework at school.	____	____
8. I find it difficult to concentrate on my studies at home.	____	____
9. I work best in a library.	____	____
10. I can study almost anywhere.	____	____
11. I like to study in bed.	____	____
12. I like to study on carpeting or rugs.	____	____
13. I can study on the floor, in a chair, on a couch, and at my desk.	____	____
14. I often study in the bathroom.	____	____

II. Emotional Stimuli:

A. Motivation Toward School Work:

	True	False
1. I feel good when I do well in school.	____	____
2. I feel good making my mother or father proud of me when I do well in school.	____	____
3. My teacher feels good when I do well in school.	____	____
4. Significant others are pleased if I bring home good reports.	____	____
5. Significant others are pleased when I do well in school.	____	____
6. I like making someone feel proud of me.	____	____
7. I am embarrassed when my grades are poor.	____	____
8. It is more important to me to do well in things that happen out of school than in my school work.	____	____
9. I like making my teacher proud of me.	____	____
10. No one really cares if I do well in school.	____	____
11. My teacher cares about me.	____	____
12. My parent(s) cares about my grades.	____	____
13. My husband cares about my grades.	____	____
14. My teacher cares about my grades.	____	____
15. Someone cares about my grades in school.	____	____
16. I want to get good grades for me!	____	____
17. I am happy when I do well in school.	____	____
18. I feel bad and work less when my grades are bad.	____	____
19. I feel happy and proud when my marks are good.	____	____
20. There are many things I like doing better than going to school.	____	____
21. I love to learn new things.	____	____
22. A good education will help me to get a good job.	____	____

B. Persistence:

	True	False
1. I try to finish what I start.	____	____
2. I usually finish what I start.	____	____
3. I sometimes lost interest in things I began to do and then stop doing them.	____	____
4. I rarely finish things that I start.	____	____
5. I usually remember to finish my homework.	____	____
6. I often have to be reminded to do my homework.	____	____
7. I often forget to do or finish my homework.	____	____
8. I often get tired of doing things and want to start something new.	____	____
9. I usually like to finish things that I start.	____	____
10. My teacher is always telling me to finish things I have been told to do.	____	____
11. Significant others remind me to finish things that I have been told to do.	____	____
12. Often signiciant others tell me to finish things that I have started.	____	____
13. Somebody's always reminding me to do something!	____	____
14. I often get tired of doing things.	____	____
15. I often want help in finishing things.	____	____
16. I like getting things done!	____	____
17. I like to get things done so I can start something new.	____	____
18. I remember on my own to get things done.	____	____

C. Responsibility:

	True	False
1. I think I am responsible.	____	____
2. People tell me that I am responsible.	____	____
3. I always do what I promise to do.	____	____
4. People say that I do what I said I would do.	____	____
5. I do keep my promises most of the time.	____	____
6. I have to be reminded over and over again to do the things I have been told to do.	____	____
7. If my teachers tells me to do something, I try to do it.	____	____
8. I keep forgetting to do the things I have been told to do.	____	____
9. I remember to do what I am told to do.	____	____
10. People keep reminding me to do things.	____	____
11. I like doing what I am supposed to do.	____	____
12. Promises have to be kept.	____	____
13. I have to be reminded often to do something.	____	____

D. Structure:

	True	False
1. I like to be told exactly what to do.	____	____
2. I like to be able to do things in my own way.	____	____
3. I like to be given choices of how I can do things.	____	____
4. I like to be able to work things out for myself.	____	____
5. I like for other people to tell me how to do things.	____	____
6. I do better if I know my work is going to be checked.	____	____
7. I do the best I can whether or not the teacher will check my work.	____	____
8. I hate working hard on something that isn't checked by the teacher.	____	____
9. I like to be given clear directions when starting new projects.	____	____

III. Sociological Stimuli:

	True	False
A. When I really have a lot of studying to do:		
1. I like to work alone.	____	____
2. I like to work with a good friend.	____	____
3. I like to work with a couple of my friends.	____	____
4. I like to work in a group of five or six classmates.	____	____
5. I like to work with an adult.	____	____
B. The things I like doing best, I do:		
1. alone.	____	____
2. with one friend.	____	____
3. with a couple of friends.	____	____
4. with a group of friends.	____	____

~~grown-up~~

IV. Physical:

	True	False
A. Perceptual Preferences:		
1. If I have to learn something new, I like to learn about it by:		
a. reading a book.	____	____
b. hearing a record.	____	____
c. hearing a tape.	____	____
d. seeing a filmstrip.	____	____
e. seeing a hearing a movie.	____	____
f. looking at pictures and having someone explain them.	____	____
g. hearing my teacher tell me.	____	____
h. playing games.	____	____
i. going someplace and seeing for myself.	____	____
j. having someone show me.	____	____

	True	False
2. The things I remember best are the things:		
a. my teacher tells me.	____	____
b. someone other than my teacher tells me.	____	____
c. someone shows me.	____	____
d. I learned about on trips.	____	____
e. I read.	____	____
f. I heard on records.	____	____
g. I heard on the radio.	____	____
h. I saw on television.	____	____
i. I wrote stories about.	____	____
j. I saw in a movie.	____	____
k. I tried or worked on.	____	____
l. my friends and I talked about.	____	____

	True	False
3. I really like to:		
a. read books, magazines, or newspapers.	____	____
b. see movies.	____	____
c. listen to records.	____	____
d. make tapes on a tape recorder.	____	____
e. draw.	____	____
f. look at pictures.	____	____
g. play games.	____	____
h. talk to people.	____	____
i. listen to people talk.	____	____
j. listen to the radio.	____	____
k. watch television.	____	____
l. go on trips.	____	____
m. learn new things.	____	____
n. study with friends.	____	____
o. build things.	____	____
p. do experiments.	____	____
q. take pictures or movies.	____	____
r. use typewriters, computers, calculators, or other machines.	____	____
s. go to the library.	____	____
t. trace things in sand.	____	____
u. mold things with my hands.	____	____

B. Intake:

	True	False
1. I like to eat or drink or chew while I study.	____	____
2. I dislike eating or drinking or chewing while I study.	____	____
3. While I am studying, I like to:		
a. eat.	____	____
b. drink.	____	____
c. chew gum.	____	____
d. nibble on snacks.	____	____
e. suck on candy.	____	____
4. I can eat, drink or chew only after I finish studying.	____	____
5. I usually eat or drink when I am nervous or upset.	____	____
6. I hardly ever eat when I am nervous or upset.	____	____
7. I could study better if I could eat while I am learning.	____	____
8. While I am learning, eating something would distract me.	____	____
9. I often catch myself chewing on a pencil as I study.	____	____

C. Time:

	True	False
1. I hate to get up in the morning.	____	____
2. I hate to go to sleep at night.	____	____
3. I could sleep all morning.	____	____
4. I stay awake for a long time after I get into bed.	____	____
5. I feel wide awake after 10:00 in the morning.	____	____
6. If I stay up very late at night, I get too sleepy to remember anything.	____	____
7. I feel sleepy after lunch.	____	____
8. When I have homework to do, I like to get up early in the morning to do it.	____	____
9. When I can, I do my homework after dinner.	____	____
10. I usually start my homework after dinner.	____	____
11. I could stay up all night.	____	____
12. I wish school would start near lunchtime.	____	____
13. I wish I could stay home during the day and go to school at night.	____	____
14. I like going to school in the morning.	____	____
15. I can remember things when I study them:	____	____
a. in the morning.	____	____
b. at lunchtime.	____	____
c. in the afternoon.	____	____
d. before dinner.	____	____
e. after dinner.	____	____
f. late at night.	____	____

D. Mobility:

	True	False
1. When I study, I often get up to do something (like take a drink, get a cookie, etc) and then return to work.	____	____
2. When I study, I stay with it until I am finished and then I get up.	____	____
3. It is difficult for me to sit in one place for a long time.	____	____
4. I often change my position when I work.	____	____
5. I can sit in one place for a long time.	____	____
6. I can constantly change position in my chair.	____	____
7. I can work best for short amounts of time with breaks in between.	____	____
8. I like getting my work done and over with.	____	____
9. I like to work a little, stop, return to the work, stop, return to the work, etc.	____	____
10. I like to stick to a job and finish it in one sitting.	____	____
11. I leave most jobs for the last minute and then have to work on them from beginning to end.	____	____
12. I do most of my jobs a little at a time and eventually get them done.	____	____
13. I enjoy doing something over and over again when I know how to do it well.	____	____
14. I like familiar friends and places.	____	____
15. New jobs and subjects make me nervous.	____	____

This "Learning Styles Questionnaire" is a modified version of that developed by Rita and Kenneth Dunn and found in Educator's Self-Teaching Guide to IndividualizingInstruction (1975). Parker Publishing Company.

MYERS-BRIGGS TYPE INDICATOR

FORM GH

by Katharine C. Briggs and Isabel Briggs Myers

DIRECTIONS:

There are no "right" or "wrong" answers to these questions. Your answers will help show how you like to look at things and how you like to go about deciding things. Knowing your own preferences and learning about other people's can help you understand where your special strengths are, what kinds of work you might enjoy and be successful doing, and how people with different preferences can relate to each other and be valuable to society.

Read each question carefully and mark your answer on the separate answer sheet. *Make no marks on the question booklet.* Do not think too long about any question. If you cannot decide on a question, skip it but be careful that the *next* space you mark on the answer sheet has the same number as the question you are then answering.

Read the directions on your answer sheet, fill in your name and any other facts asked for and, unless you are told to stop at some point, work through until you have answered all the questions you can.

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PART I. Which Answer Comes Closer to Telling How You Usually Feel or Act?

1. When you go somewhere for the day, would you rather
   (A) plan what you will do and when, or
   (B) just go?

2. If you were a teacher, would you rather teach
   (A) fact courses, or
   (B) courses involving theory?

3. Are you usually
   (A) a "good mixer," or
   (B) rather quiet and reserved?

4. Do you prefer to
   (A) arrange dates, parties, etc., well in advance, or
   (B) be free to do whatever looks like fun when the time comes?

5. Do you usually get along better with
   (A) imaginative people, or
   (B) realistic people?

6. Do you more often let
   (A) your heart rule your head, or
   (B) your head rule your heart?

7. When you are with a group of people, would you usually rather
   (A) join in the talk of the group, or
   (B) talk with one person at a time?

8. Are you more successful
   (A) at dealing with the unexpected and seeing quickly what should be done, or
   (B) at following a carefully worked out plan?

9. Would you rather be considered
   (A) a practical person, or
   (B) an ingenious person?

10. In a large group, do you more often
    (A) introduce others, or
    (B) get introduced?

11. Do you admire more the people who are
    (A) conventional enough never to make themselves conspicuous, or
    (B) too original and individual to care whether they are conspicuous or not?

12. Does following a schedule
    (A) appeal to you, or
    (B) cramp you?

13. Do you tend to have
    (A) deep friendships with a very few people, or
    (B) broad friendships with many different people?

14. Does the idea of making a list of what you should get done over a weekend
    (A) appeal to you, or
    (B) leave you cold, or
    (C) positively depress you?

15. Is it a higher compliment to be called
    (A) a person of real feeling, or
    (B) a consistently reasonable person?

16. Among your friends, are you
    (A) one of the last to hear what is going on, or
    (B) full of news about everybody?

[On this next question *only*, if two answers are true, mark both.]

17. In your daily work, do you
    (A) rather enjoy an emergency that makes you work against time, or
    (B) hate to work under pressure, or
    (C) usually plan your work so you won't *need* to work under pressure?

18. Would you rather have as a friend
    (A) someone who is always coming up with new ideas, or
    (B) someone who has both feet on the ground?

19. Do you
    (A) talk easily to almost anyone for as long as you have to, or
    (B) find a lot to say only to certain people or under certain conditions?

20. When you have a special job to do, do you like to
    (A) organize it carefully before you start, or
    (B) find out what is necessary as you go along?

21. Do you usually
    (A) value sentiment more than logic, or
    (B) value logic more than sentiment?

22. In reading for pleasure, do you
    (A) enjoy odd or original ways of saying things, or
    (B) like writers to say exactly what they mean?

23. Can the new people you meet tell what you are interested in
    (A) right away, or
    (B) only after they really get to know you?

24. When it is settled well in advance that you will do a certain thing at a certain time, do you find it
    (A) nice to be able to plan accordingly, or
    (B) a little unpleasant to be tied down?

25. In doing something that many other people do, does it appeal to you more to
    (A) do it in the accepted way, or
    (B) invent a way of your own?

26. Do you usually
    (A) show your feelings freely, or
    (B) keep your feelings to yourself?

Go on to Part II.

PART II. Which Word in Each Pair Appeals to You More?

Think what the words mean, not how they look or how they sound.

27.	(A)	scheduled	unplanned	(B)	50.	(A)	sensible	fascinating	(B)
28.	(A)	gentle	firm	(B)	51.	(A)	forgive	tolerate	(B)
29.	(A)	facts	ideas	(B)	52.	(A)	production	design	(B)
30.	(A)	thinking	feeling	(B)	53.	(A)	impulse	decision	(B)
31.	(A)	hearty	quiet	(B)	54.	(A)	who	what	(B)
32.	(A)	convincing	touching	(B)	55.	(A)	speak	write	(B)
33.	(A)	statement	concept	(B)	56.	(A)	uncritical	critical	(B)
34.	(A)	analyze	sympathize	(B)	57.	(A)	punctual	leisurely	(B)
35.	(A)	systematic	spontaneous	(B)	58.	(A)	concrete	abstract	(B)
36.	(A)	justice	mercy	(B)	59.	(A)	changing	permanent	(B)
37.	(A)	reserved	talkative	(B)	60.	(A)	wary	trustful	(B)
38.	(A)	compassion	foresight	(B)	61.	(A)	build	invent	(B)
39.	(A)	systematic	casual	(B)	62.	(A)	orderly	easygoing	(B)
40.	(A)	calm	lively	(B)	63.	(A)	foundation	spire	(B)
41.	(A)	benefits	blessings	(B)	64.	(A)	quick	careful	(B)
42.	(A)	theory	certainty	(B)	65.	(A)	theory	experience	(B)
43.	(A)	determined	devoted	(B)	66.	(A)	sociable	detached	(B)
44.	(A)	literal	figurative	(B)	67.	(A)	sign	symbol	(B)
45.	(A)	firm-minded	warm-hearted	(B)	68.	(A)	party	theater	(B)
46.	(A)	imaginative	matter-of-fact	(B)	69.	(A)	accept	change	(B)
47.	(A)	peacemaker	judge	(B)	70.	(A)	agree	discuss	(B)
48.	(A)	make	create	(B)	71.	(A)	known	unknown	(B)
49.	(A)	soft	hard	(B)					

Go on to Part III

PART III. Which Answer Comes Closer to Telling How You Usually Feel or Act?

72. Would you say you
    (A) get more enthusiastic about things than the average person, or
    (B) get less excited about things than the average person?

73. Do you feel it is a worse fault to be
    (A) unsympathetic, or
    (B) unreasonable?

74. Do you
    (A) rather prefer to do things at the last minute, or
    (B) find doing things at the last minute hard on the nerves?

75. At parties, do you
    (A) sometimes get bored, or
    (B) always have fun?

76. Do you think that having a daily routine is
    (A) a comfortable way to get things done, or
    (B) painful even when necessary?

77. When something new starts to be the fashion, are you usually
    (A) one of the first to try it, or
    (B) not much interested?

78. When you think of some little thing you should do or buy, do you
    (A) often forget it till much later, or
    (B) usually get it down on paper to remind yourself, or
    (C) always carry through on it without reminders?

79. Are you
    (A) easy to get to know, or
    (B) hard to get to know?

80. In your way of living, do you prefer to be
    (A) original, or
    (B) conventional?

81. When you are in an embarrassing spot, do you usually
    (A) change the subject, or
    (B) turn it into a joke, or
    (C) days later, think of what you should have said?

82. Is it harder for you to adapt to
    (A) routine, or
    (B) constant change?

83. Is it higher praise to say someone has
    (A) vision, or
    (B) common sense?

84. When you start a big project that is due in a week, do you
    (A) take time to list the separate things to be done and the order of doing them, or
    (B) plunge in?

85. Do you think it more important to be able
    (A) to see the possibilities in a situation, or
    (B) to adjust to the facts as they are?

86. Do you think the people close to you know how you feel
    (A) about most things, or
    (B) only when you have had some special reason to tell them?

87. Would you rather work under someone who is
    (A) always kind, or
    (B) always fair?

88. In getting a job done, do you depend on
    (A) starting early, so as to finish with time to spare, or
    (B) the extra speed you develop at the last minute?

89. Do you feel it is a worse fault
    (A) to show too much warmth, or
    (B) not to have warmth enough?

90. When you are at a party, do you like to
    (A) help get things going, or
    (B) let the others have fun in their own way?

91. Would you rather
    (A) support the established methods of doing good, or
    (B) analyze what is still wrong and attack unsolved problems?

92. Are you more careful about
    (A) people's feelings, or
    (B) their rights?

93. If you were asked on a Saturday morning what you were going to do that day, would you
    (A) be able to tell pretty well, or
    (B) list twice too many things, or
    (C) have to wait and see?

94. In deciding something important, do you
    (A) find you can trust your feeling about what is best to do, or
    (B) think you should do the *logical* thing, no matter how you feel about it?

95. Do you find the more routine parts of your day
    (A) restful, or
    (B) boring?

96. Does the importance of doing well on a test make it generally
    (A) easier for you to concentrate and do your best, or
    (B) harder for you to concentrate and do yourself justice?

97. Are you
    (A) inclined to enjoy deciding things, or
    (B) just as glad to have circumstances decide a matter for you?

98. In listening to a new idea, are you more anxious to
    (A) find out all about it, or
    (B) judge whether it is right or wrong?

99. In any of the ordinary emergencies of everyday life, would you rather
    (A) take orders and be helpful, or
    (B) give orders and be responsible?

100. After being with superstitious people, have you
    (A) found yourself slightly affected by their superstitions, or
    (B) remained entirely unaffected?

101. Are you more likely to speak up in
    (A) praise, or
    (B) blame?

102. When you have a decision to make, do you usually
    (A) make it right away, or
    (B) wait as long as you reasonably can before deciding?

103. At the time in your life when things piled up on you the worst, did you find
    (A) that you had gotten into an impossible situation, or
    (B) that by doing only the necessary things you could work your way out?

104. Out of all the good resolutions you may have made, are there
    (A) some you have kept to this day, or
    (B) none that have really lasted?

105. In solving a personal problem, do you
    (A) feel more confident about it if you have asked other people's advice, or
    (B) feel that nobody else is in as good a position to judge as you are?

106. When a new situation comes up which conflicts with your plans, do you try first to
    (A) change your plans to fit the situation, or
    (B) change the situation to fit your plans?

107. Are such emotional "ups and downs" as you may feel
    (A) very marked, or
    (B) rather moderate?

108. In your personal beliefs, do you
    (A) cherish faith in things that cannot be proved, or
    (B) believe only those things that can be proved?

109. In your home life, when you come to the end of some undertaking, are you
    (A) clear as to what comes next and ready to tackle it, or
    (B) glad to relax until the next inspiration hits you?

110. When you have a chance to do something interesting, do you
    (A) decide about it fairly quickly, or
    (B) sometimes miss out through taking too long to make up your mind?

111. If a breakdown or mix-up halted a job on which you and a lot of others were working, would your impulse be to
(A) enjoy the breathing spell, or
(B) look for some part of the work where you could still make progress, or
(C) join the "trouble-shooters" in wrestling with the difficulty?

112. When you don't agree with what has just been said, do you usually
(A) let it go, or
(B) put up an argument?

113. On most matters, do you
(A) have a pretty definite opinion, or
(B) like to keep an open mind?

114. Would you rather have
(A) an opportunity that may lead to bigger things, or
(B) an experience that you are sure to enjoy?

115. In managing your life, do you tend to
(A) undertake too much and get into a tight spot, or
(B) hold yourself down to what you can comfortably handle?

116. When playing cards, do you enjoy most
(A) the sociability, or
(B) the excitement of winning, or
(C) the problem of getting the most out of each hand,
(D) or don't you enjoy playing cards?

117. When the truth would not be polite, are you more likely to tell
(A) a polite lie, or
(B) the impolite truth?

118. Would you be more willing to take on a heavy load of extra work for the sake of
(A) extra comforts and luxuries, or
(B) a chance to achieve something important?

119. When you don't approve of the way a friend is acting, do you
(A) wait and see what happens, or
(B) do or say something about it?

120. Has it been your experience that you
(A) often fall in love with a notion or project that turns out to be a disappointment—so that you "go up like a rocket and come down like the stick", or do you
(B) use enough judgment on your enthusiasms so that they do not let you down?

121. When you have a serious choice to make, do you
(A) almost always come to a clear-cut decision, or
(B) sometimes find it so hard to decide that you do not wholeheartedly follow up either choice?

122. Do you usually
(A) enjoy the present moment and make the most of it, or
(B) feel that something just ahead is more important?

123. When you are helping in a group undertaking, are you more often struck by
(A) the cooperation, or
(B) the inefficiency,
(C) or don't you get involved in group undertakings?

124. When you run into an unexpected difficulty in something you are doing, do you feel it to be
(A) a piece of bad luck, or
(B) a nuisance, or
(C) all in the day's work?

125. Which mistake would be more natural for you:
(A) to drift from one thing to another all your life, or
(B) to stay in a rut that didn't suit you?

126. Would you have liked to argue the meaning of
(A) a lot of these questions, or
(B) only a few?

APPENDIX C

NSF PARTICIPANT PROJECTS- SUMMER 1995

The goal of having you do this project is to help you implement the ideas and/or materials from this institute into your daily classroom. The focus of the project should be **to bring about interest and active participation by your students in learning mathematics**. This includes using such thing as computers and manipulatives and not simply worksheet drilling them to death.

General guidelines

1. You should have a list of mathematical objectives that your project would teach your students. These may be crossed referenced with the State Course of Study and/or the NCTM Standards.
2. You should provide a complete written description of your project. This may take the form of actual lesson plans, written descriptions of activities, rules for games, etc.
3. You should provide a visual display of your project. This might include posters, examples of a completed student project, graphs, pictures, etc.
4. Your project must be completed and ready to display by **Thursday, July the 13th**.

Categories of projects

1. *Computer based activity projects.* These might include lessons built around student discoveries through computer usage. These should not be just using already made Supposer worksheets, although you may use some of these and adapt them to your particular lesson. You do not have to use the computer exclusively. For example, you might do a unit on statistics and use some computer software to generate graphs or data analysis.
2. *Calculator based activity projects.* You might develop a unit of instruction around calculator activities which use the TI Explorer or another calculator. Again, your unit does not have to rely solely on calculators.
3. *Probability/Statistics related projects.* Develop a project built around a probability experiment(s). These should not be simply the ones done in class, but should show some originality. You might develop a data collection and analysis project to be conducted by your students.
4. *Geometry related projects.* Develop a project around developing geometry concepts using an active discovery based approach to instruction.
5. *Manipulative based projects.* You might build a unit around pattern block activities, origami, tessellations, or any other type of hands-on manipulative.
5. *An approved topic you suggest.*